Organization and Other Features, M.C.R. Shops, St. Thomas

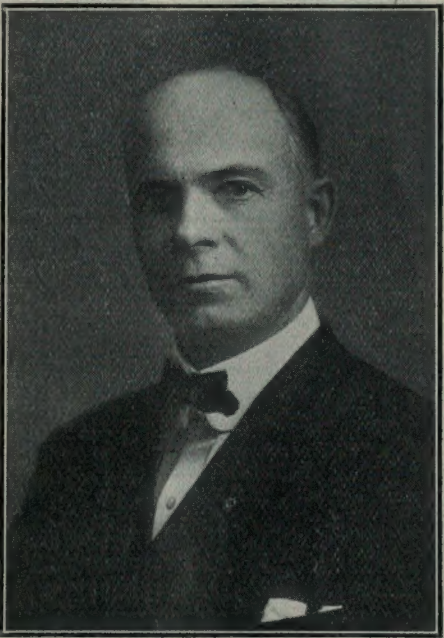
Staff Article

Railroads more so than any other department of industrial enterprise are progressive, and ample proof of the statement is to be found in the great terminal and auxiliary shops of all of the companies doing business in and beyond the Canadian border. The M. C. R. is among the latest to modernize its plant and equipment to meet its growing needs.

APPRENTICESHIP SYSTEM

FOLLOWING the introductory remarks on page 586 of our December 31 issue, on the apprenticeship system as adopted by the Michigan Central Railroad Shops at St. Thomas, Ont., it may be here stated that an attempt is made to graduate the education as much as possible to coincide with the student's work in the shop. The course includes simple mathematics such as elementary arithmetic and sufficient algebra to enable him to handle simple formulae. Physics includes leverage, inclined plane, simple triangulation, etc. Under the heading of applied mechanics comes, mensuration, simple problems in strength of materials, gearing, simple machines and the like. Particular attention is, of course, given to the theory and construction of steam engines and valve motions.

The apprentice also receives a good practical course in drafting along the lines adopted by the New York Central System which includes sketching, tracing and blue-printing. The class room is situated on the second floor of the old building adjacent to the business offices. It is well lighted by windows on two sides and is provided with black boards, drawing benches, stools, etc. The equipment also includes models of steam engines, and the various valve gears in use on locomotives. There are also types of lubricators, injectors and other engine attachments as well as pulleys, scales, weights, etc., for the illustration of physics. The whole, while comprising an outfit particularly adapted to railroad work is one which many technical schools can study with profit.

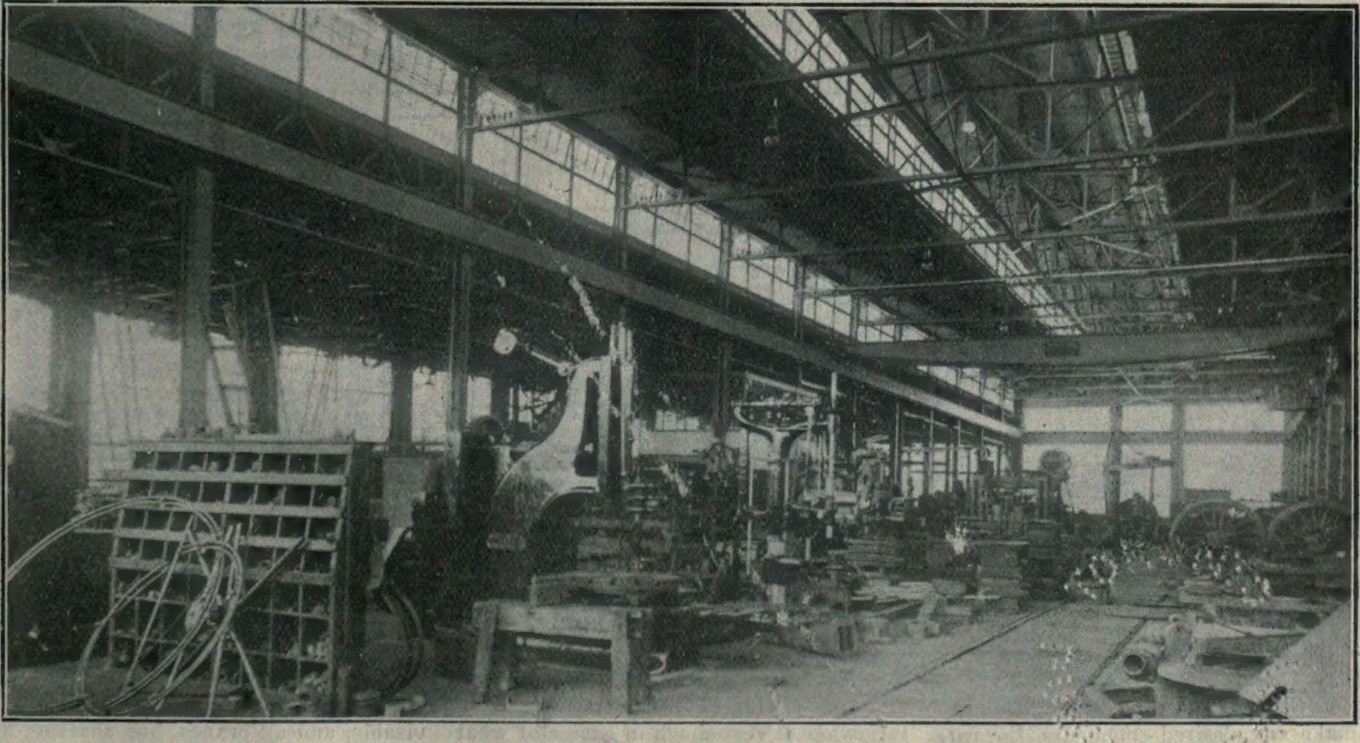


E. R. WEBB, DIVISION MASTER MECHANIC.

The apprentice system of the Michigan Central Railway is decidedly excellent from both a business and humanitarian point of view. All of its good points are no doubt unappreciated by the apprentices themselves until such time as they branch out to find work and experience in other plants. The benefits to be derived from surrounding the institution with a distinctly superior type of men and officials has been found to be one of the best assurances of its success and the money invested in the man through the apprentice system is coming back in the form of a general contentment and good will, and a remarkable and highly creditable absence of labor disputes.

The Organization.

To the thoughtful observer the plant and its working reflects the character, the personality and even the peculiarities of the men who direct. It has been said by a great business man that the traveler desiring to sell goods and the mechanic seeking employment can best understand the man at the helm by a study of the atmosphere and spirit



WEST SIDE OF HEAVY MACHINE BAY, LOOKING NORTH.

which pervades his place of business. To the railroad man the organization of the railroad shop is easily comprehended and, perhaps, presents few points of interest. Nevertheless, the railroad business is probably the most competitive one in America to-day and, considering the vastness of its field, the variety of shop work involved is not large, both of which considerations go to make the official of the railroad shop the best authority on such points of shop government as come within his sphere.

The shops and terminal works come under the department of the superintendent of motive power who exercises a personal supervision over the general details. The shops themselves come more directly under the office of the divisional master mechanic and his assistant in all cases where mechanical details and expediency are concerned. This office is very much similar to that of the general superintendent of our larger manufacturing concerns and, like it, covers all the departments of the plant. The machine shops are directly under the supervision of a general foreman through department heads which, in the case of the shops at St. Thomas, consist in general of machine shop foreman and assistant, erecting shop foreman, tool room foreman, etc. In conjunction with this office and also directly under the master mechanic is the chief draughtsman who also superintends the technical training of the apprentices.

Piecework Rate System.

A guaranteed rate piece work system is employed which, when operated upon the equitable basis maintained by this company is, without doubt, very satisfactory to both officials and operatives. The rating of all piece work is governed by a general policy of the company and is directed by the general supervisor of piece-work through a chief inspector and a local supervisor inspector in each shop. This item in the shop management is given primary importance.

In setting the rate for a new job, the basis adopted is 25 per cent. in excess of the day rate for the class of man involved. After a careful study of the records of other shops of the company concerning the particular piece of work and taking into account the conditions prevailing in the local shop, a trial rate is set. This is written upon a special form which bears the signatures of five company officials which include the divisional superintendent, master mechanic, supervisor of piece-work, chief piece-work inspector and the local piece-work inspector.

After the job has been thoroughly tried out and the workman and others concerned have been given opportunity to make any desired comments, the rate is confirmed or corrected and, after being entered upon a final form receives the same signatures as before and, in addition those of the general foreman and the mechanic himself. Having reached this stage, the rate for the particular work in question is not altered either in

GEORGE CARR,
General Foreman, M.C.R. Shops, St. Thomas.

favor of the company or the employee. In fact, the broad general statement is made that no price after having once been set has ever been changed.

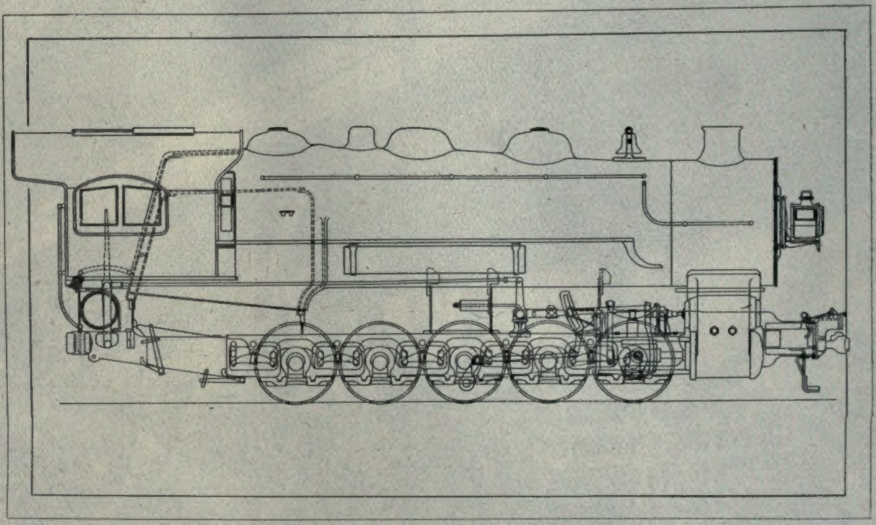
The advantage of this rigid rate discipline is apparent. The man devotes both his head and his hands to the production of more and a better quality of work, being assured that his efforts will be proportionately rewarded independently of the extent of his success. The result of this has been that a number of men have been able to so contrive labor and time-saving devices that their monthly wage is very much in excess of what was originally intended by either party to the agreement. The result, however, is obtained usually without increase of floor space or capital investment on the part of the company and hence is satisfactory to both.

Piece-work systems, as a rule, have suffered failure more or less complete through their vulnerability to the cupidity of both employer and employee. The success of this M. C. R. Co. at St. Thomas, goes to show that even organized workmen are not unchangeably opposed to a system based on fairness and sound business principles, and which is administered by men whose personality and integrity are strong and beyond reproach.

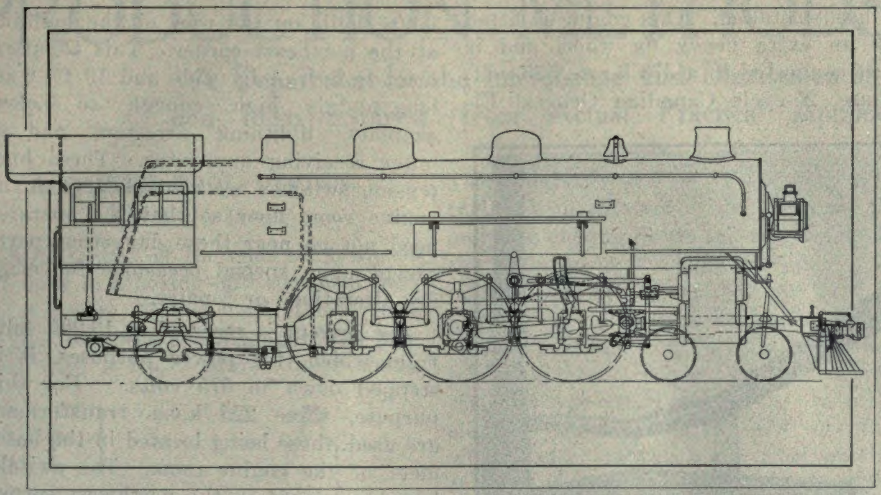
The different stages in dismemberment and reconstruction are performed by separate crews or "gangs." Each gang adheres strictly to its range of work, but the men are interchangeable within the crew. Every gang has its portable outfit and tool box which is taken from one engine to another. In this way the work is done with the least interference and expenditure of time, and some very creditable records have been established. The routing of the work also has received a great amount of attention and has been brought to such a condition as to almost look after itself. The relieving of the foremen of many such details has permitted a much greater proportion of his time to be devoted to the more important work of planning and strict supervision.

Safety First and Workmen's Welfare.

Precautions for the safety of workmen and the continuous and smooth working of machinery leave little to be desired. Most of the machines are of the more advanced types which come amply provided with gear and belt guard, and safety attachments. These have been largely supplemented by the shop management where deemed necessary or advisable, and all cranes, line shafting and



N.Y.C. SWITCHING LOCOMOTIVE, CLASS M. WORK OF APPRENTICE SCHOOL, M.C.R. SHOPS, ST. THOMAS.



N.Y.C. PACIFIC TYPE PASSENGER LOCOMOTIVE. WORK OF APPRENTICE SCHOOL, M.C.R. SHOPS, ST. THOMAS.

other moving parts have been fully guarded.

Large and conspicuous warning signs are placed in all dangerous places so that a workman cannot be long in the institution without acquiring the "Take care" habit. Upon each individual machine is placed a striking, small red and white sign admonishing the operator to stop the machine before oiling or cleaning it.

The shop is provided with a medicine cabinet containing all first aid appliances and drugs, and provision is made by the brotherhood for the care of injured men as long as they remain incapacitated. The company are in the possession of some very interesting records bearing upon the benefits direct and indirect accruing from the "safety first" efforts. Suffice to say that the prevention from injury and the maintenance of the individual health of the employees have proved a very profitable and humanitarian investment.

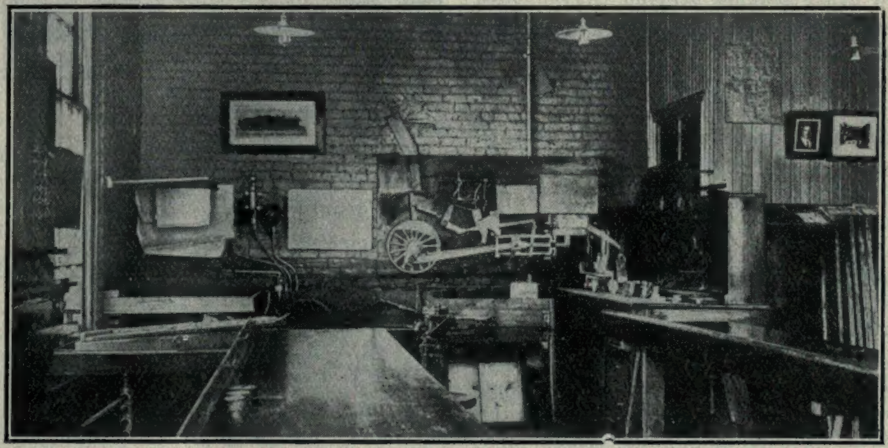
Sanitary Arrangements.

A well appointed lavatory has been erected near the centre of the building on the west side. It is equipped with 56 individual enameled cast iron wash basins which are supplied with hot and cold water. The walls are lined with over 200 "Dennisteel" expanded metal lockers. The sanitary arrangements are of the same general good quality and the whole is so arranged as to afford the best facilities for cleaning. An unusual feature is the installation of a number of unobtrusive sanitary conveniences at strategical points about the shop. These are located at the bases of columns in such a way that they would most likely pass notice unless attention were called to them. Neat and substantial porcelain sanitary drinking fountains are distributed at convenient points throughout the shop. The aim in every respect has been the health of the employees, coupled with the best facilities for maintaining cleanliness.

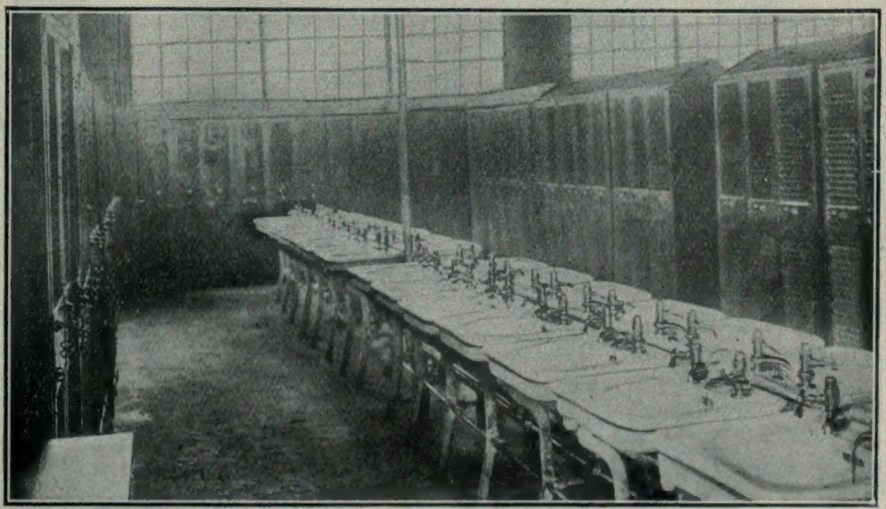
The Power and Heating Plant.

A new power house has been built to the southeast of the new round house, and between it and the car shops. The building is approximately 87 feet square, and is divided by a single wall running east and west into boiler and engine room, each of which is 42 feet wide inside. The construction of the building is very similar to the new locomotive shops. The concrete foundation extends up to the lower sill line. Upon this rest the brick walls which, in turn, support the roof trusses. The side walls consist of a very large proportion of glass area more than half of which is made up of ventilated sections. The glass itself consists of ⅛ inch factory ribbed glass supported in continuous steel sash. The roof slabs of reinforced concrete are supported on I beam purlins and are covered wth five-ply roofing material.

Under the boiler room is an ash tunnel which traverses its whole length. This is provided with a track and leads to a pneumatic elevator by means of which the ashes are hoisted to be conveniently dumped into cars for removal. A basement extends under the greater portion of the engine room and is used to accommodate the transformer units. The south or boiler room side is occupied by a coal bin of 300 tons capacity which extends the full length of the building. Over the coal bunker is a wood trestle up which loaded coal cars can be switched and dumped into the bin below. Smoke and products of com-



APPRENTICE CLASS ROOM SHOWING DRAWING BENCHES AND MODELS.



LAVATORY SHOWING BASINS AND EXPANDED METAL LOCKERS.

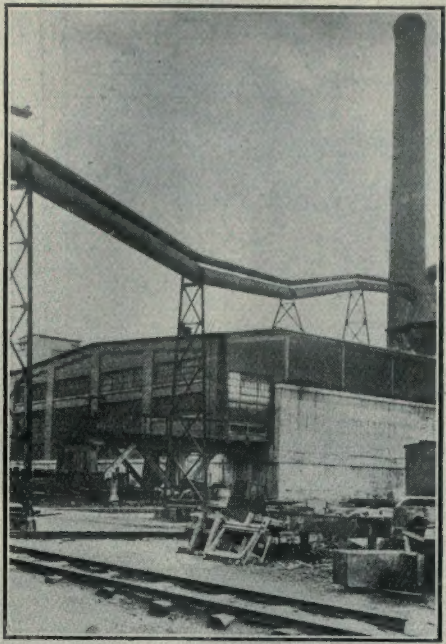
bustion are taken care of by an Alphons-Custodis radial brick chimney 7½ feet inside diameter and 150 feet high. A concrete tunnel 6 ft. high and 4 ft. wide leads from the power house to the car shops for the purpose of carrying the steam and compressed air lines. From this point they are distributed overhead to the woodworking departments, yards and locomotive shops. A suction system with its attendant piping and separating apparatus has been installed for the purpose of collecting all the sawdust, shavings and similar wood refuse and delivering it to two of the boiler furnaces which have been specially arranged to burn this kind of fuel. Previous to the building of the new power plant this refuse had been disposed of by manual labor.

Equipment.

The boiler room is equipped with four 250 h.p. Goldie & McCulloch water tube boilers designed for a working pressure of 160 pounds per square inch. The furnaces are fitted with Green traveling chain grate stokers. From the bunkers directly in front of the boilers. The coal is shovelled into hoppers from which it is taken by the moving chain grate. The ashes and clinker drop from the grates into sloping chambers underneath the boilers. From these, they are raked into buggies which, as before stated, are hoisted out and dumped into cars for the purpose.

A steel breeching connects the furnaces with the stack which gives abundant natural draft. A special steam blowing arrangement is provided which greatly facilitates cleaning and general combustion. The steam main runs along the division wall on the boiler room side, the supply for the various units being taken through the wall to the engine room side.

For the development of electrical energy, a 22 x 42 inch Corliss engine built by E. Leonard & Sons, of London, Ont., has been installed. This engine is fitted with an extra heavy fly wheel and is direct connected to a 375 k.v.a., 575-volt, 3-phase, 25-cycle Canadian General El-



NEW POWER PLANT.

ectric generator, the exciting current for which is furnished by an 18½ k.w. belt driven generator.

The electrical apparatus was designed to conform to the standards adopted by the Ontario Hydro Electric Commission so as to permit the use of this current as well as that developed at the plant. It has been found after careful investigation that power, as such, can be purchased more cheaply than it can be developed from coal. Power, therefore, is only developed in the winter time when the exhaust steam is required for heating purposes.

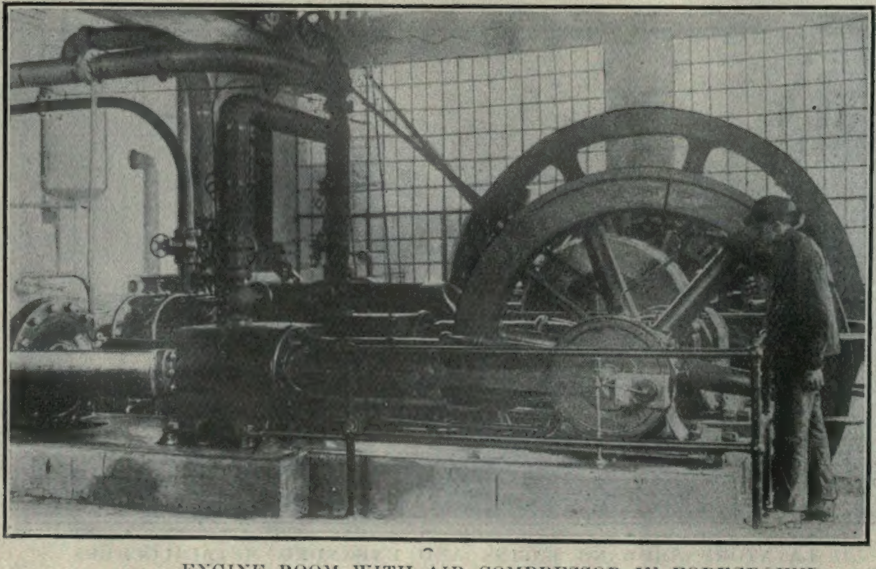
The high tension lines of the Hydro-Electric Commission are led into a pent house built on the roof of the building at the northeast corner. This compartment is 6 ft. 4 in. wide and 10 ft. 6 in. long and is high enough to enclose switches, lightning arresters and all other receiving apparatus. These high tension switches are controlled from the engine room floor so that the operator need not go near these dangerous parts except upon special occasions for making alterations or repairs.

The current is received at 13,200 volts from which, for power purposes, it is stepped down to 575 volts. For this purpose, three 225 k.v.a. transformers are used, these being located in the basement of the engine room. The switchboard is placed in the northwest corner of the engine room and is made up of nine marble panels. It is fitted with a duplex system of bus bars and switching apparatus so as to control the incoming Hydro current, the generator, the transformers and all outgoing feeder circuits for power and light. The result is that energy from either source of supply can be instantly distributed to any part of the plant for any purpose.

For lighting purposes both the generator and hydro current are transformed from 575 volts to 127-254 volts. All inside wiring is encased in conduit, while the outside lines are carried both on poles and underground in clay conduits. In the erecting and heavy machine tool bays of the locomotive shop where the operation of traveling cranes necessitates the placing of lamps at a considerable distance from the floor, flaming arc lamps with reflectors have been installed. Other buildings including the light machine tool bay, the power house, car shops and the older buildings are lighted by incandescent tungstens of various capacities. In all, about fifty flaming arc lamps are in use.

Heating Plant.

The heating of the plant is done from the central power station through the medium of the indirect hot air system. As before stated, the company develop their own power only as a by product of the heating plant. For the locomotive shop, the exhaust steam is delivered through a tunnel to the fan room on the east side of the building. Here it is condensed in cast iron "Vento" radiators. The air to be heated is drawn through these coils by means of a steam engine driving a "Sirocco" blower. The heated air is forced through both underground concrete ducts and overhead sheet metal pipes, and is systematically distributed throughout the building so as to produce as even a temperature as possible and, at the same time, the hot air does not blow directly upon the workmen.



ENGINE ROOM WITH AIR COMPRESSOR IN FOREGROUND

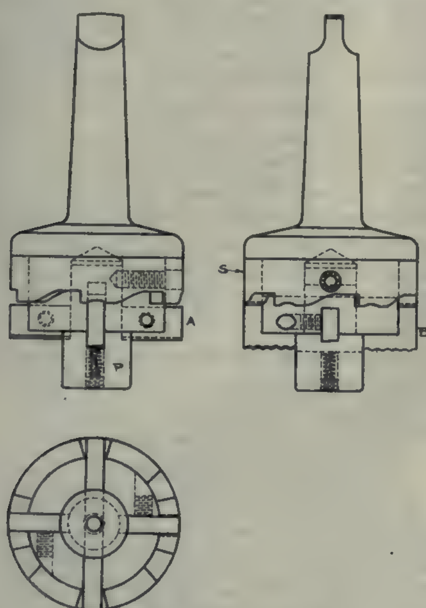
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A FACING TOOL DESIGN.

By A. L. Loy.

FOR facing off the ends of flywheels hubs in a boring mill equipped with a centre boring head, the accompanying tool was designed. It was provided with a No. 5 Morse taper shank



FACING TOOL DESIGN.

and was driven by a tapered key through the latter but which is not shown in the drawing. The finishing cutters, AA, were held solidly in the body by means of headless set screws, and projected out to the full diameter of the body, also into the pilot P, acting as drivers for same. This pilot was 2 in. in diameter, but turned down to $1\frac{1}{2}$ in. where it entered the body. It was held in place by the headless set screw at the top which could be reached through a hole in the sleeve, S.

The sleeve was coarse knurled on the outer surface ½ in. thick, and had six stepped cams cut on the lower edge, these having a total movement of 5/16 in. It was of mild steel, casehardened and ground in the centre. These cams operated the roughing tool B, which passed entirely through both the tool body and the pilot. This tool was pressed up against the cam by the heavy spring in the lower end of the pilot, being held in by the short screw in the bottom of same.

The roughing tool was turned down at the ends so that the centre portion projected up into the knurled sleeve, thus preventing the tool from sliding or getting out of its proper position. Teeth were ground in the cutting edge to break up the scale, the teeth on the one side cutting down the ridges left by the hollows on the opposite side. The cutting edge of the rougher was 3/16 in. below that of the finisher when in the cutting position, and ⅛ in. above, when in the highest. When the tool was rotating it was only necessary to grasp the sleeve S which would cause it to rotate with respect to the body, thus putting the tool B in either the cutting or the clearance position. A slight depression was cut in the high part of the cam so that the operator could easily tell by the "feel" when the tool dropped into this. To remove the rougher it was only necessary to turn the cam ring to the clearance position and then pull the cutter down and out.

The finishing cutters were ground directly in the body, the pilot being removed for this operation. Chip grooves were also cut in the pilot but are not shown. Should the roughing tool have been ground off sufficiently as to demand any adjustment in the relative positions of it and the finishing cutters, this was easily taken care of by slipping a sheet metal ring of the proper thickness on top of the sleeve S, thereby bringing the cutter B down a corresponding amount. As this tool does not operate at a high rotative speed it is very easily handled and the particular tool in the cutting position is easily determined after becoming familiar with it. It is quite a time saver, it being unnecessary to stop the spindle as ordinarily to remove one cutter and insert another.

A CONVENIENT DRAWING TABLE

By D. S. Mann.

THERE is perhaps no labor that is more trying than continuous drafting, necessitating, as it often does, a cramped and uncomfortable position for hours at a time. Any arrangements tending to a more comfortable position of the

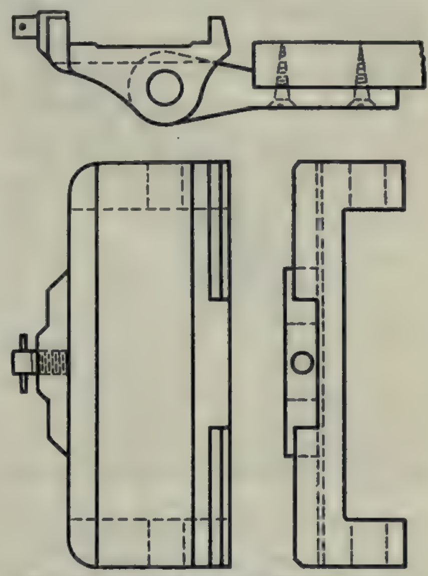


FIG. 2. DEVICE FOR HOLDING TEE SQUARE.

operator and thereby conserving his natural resources and nerve energy will be greatly appreciated and will bear fruit in an increased amount of work produced. The accompanying sketch shows

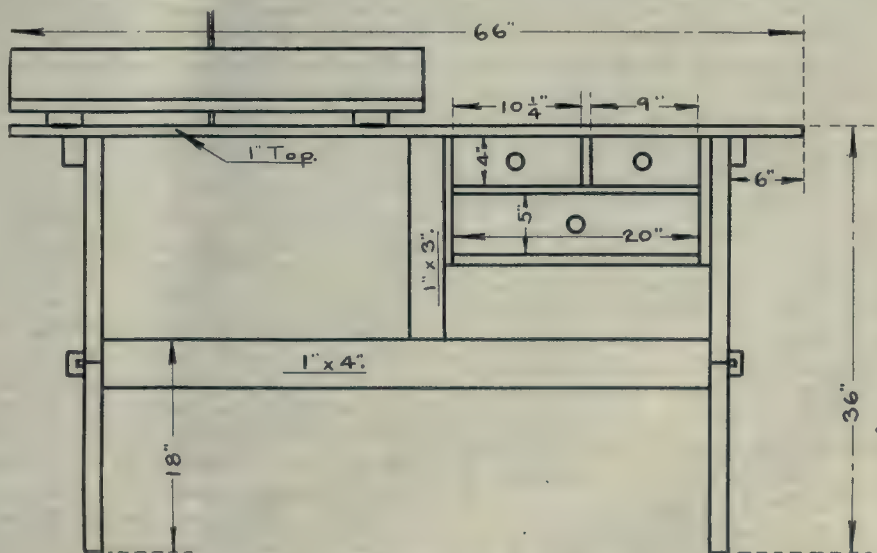


FIG. 1. CONVENIENT DRAWING TABLE.

a table used in the tool drafting department of a large concern which worked out very satisfactorily and which was

well received by the draftsmen using same.

The frame of the table was made of oak while the top was of pine so that the entire surface could be used for laying out extremely large work. This, however, rarely occurred and the ordinary arrangement was as shown. The regular drawing board was placed at the left of the table and hinged at the front, the back being supported by a flat strip

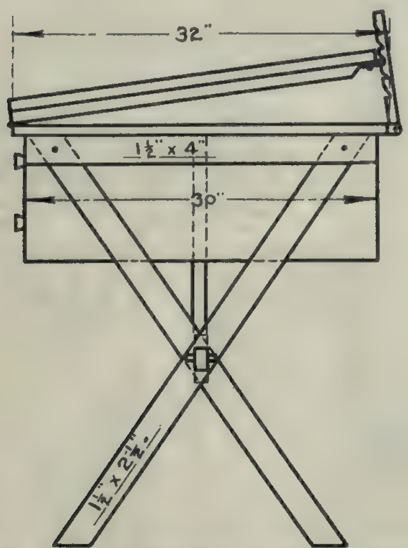


FIG. 3. CONVENIENT DRAWING TABLE.

of heavy steel in which notches had been cut, allowing for various positions of the board as regards height. The drawers at the right were large and of the full depth of the table giving good space for the storage of tools and books; anyone familiar with the ordinary type of table will readily appreciate this feature. The table space at the right was available for the use of drawings and prints which would otherwise be stacked on the drawing board proper.

In Fig. 2 is shown the device for holding the T-square. The head of the regular T-square was laid in this and clamped in place by the thumb screw at the back. This casting had two projections at the bottom, one under either end, which were reamed out ¾ in., allowing it to slide on a bar of cold drawn steel held to the board at the ends as shown. Keeping the rod slightly oiled allowed the T-square to be moved back and forth with little effort and it always remained in its proper position without any extra effort on the part of the operator. The square could also be tipped up vertically should it be desired to have the board entirely clear. The ¾ in. rod was somewhat lower than the surface of the table so that the square could be used against the edge of the board without interference, if desired.

Of course, it was impossible to bring the edges of the square entirely to either the front or back of the board, but this was seldom necessary, as the ordinary sizes of paper used were considerably less than that of the board and, should it be absolutely necessary to use the entire board surface, the brackets at the end were low enough so that the square would readily pass over them when used in the ordinary way.

ONTARIO WORKMEN'S COMPENSATION ACT RATES.

PROBABLY the most important action taken by the Workmen's Compensation Board of the Province of Ontario, since it came into power, has been the striking of rates for the taxing of employers. Notices have been sent out to the employers throughout the province advising them of the charges they will have to meet in connection with the Compensation Act. While the figures have been made as accurate as possible for the present, the board may find that by the end of 1915 some of the assessments will have to be increased and others lowered. Acting on the advice of F. S. Hinsdale, and guided by his experience, the Compensation Commission has struck rates which the chairman believes will not be too hard on the employers, and yet will suffice to operate the Act.

Rate Comparisons.

A noticeable feature of the Ontario Act is that the rates are lower than those of New York, Washington and Michigan, and in many respects lower than those of Ohio and Oregon.

The rates levied by the board are from one-half to two and three per cent. of the employers' payroll. The assessments are payable within fifteen days following the issue of the notices, but, in view of present financial conditions, the commission allow employers to pay one-half in that time and the balance at 6 per cent. on June 30, 1915.

A Low Assessment.

The rate is surprisingly low in several of the factory classes. In the clothing trade, the assessment on cloth manufacturing and closely related industries is only one-half of one per cent. of the payroll. Clothing, shirt, cap manufacturing is considered less dangerous, and employers will only have to pay .4 per cent. on the dollar. The statement sent out shows that the lumber and kindred industries are charged about two per cent., several branches of the lumber industry being grouped with the one assessment. Foundries are taxed from 1.80 to 2 per cent., according to the kind of work. The printing industry pays only one-half of one per cent.

Building Trades.

For the coming year, building trades will be charged around 2½ per cent. Structural steel working, structural carpentry, bricklaying, stone masonry and erection of concrete walls, etc., are included under this class. Lathing and plastering will be charged a rate of 2 per cent., while employers of painters will pay 2 per cent. of the payroll for outside work and 1.20 for inside work. Sheet metal work entails an assessment of 2½ per cent.

In connection with the building industry and the extent to which it will cover employment, there has been no definite statement except that of the Act itself. The Compensation Act covers every employment where that employment is made a part of the employer's business, which means that the man who builds a house to sell even if he employs but one carpenter, painter, or one or two bricklayers, must pay an assessement on their wages. The man who employs a carpenter or painter off and on at work about his own house or houses will not be called upon for a contribution. Whether the man who builds a house for himself, and does not intend to sell it, will have to pay an assessment has yet to be finally determined, but it is not considered that employment under such circumstances comes under the Act.

Assessment Collection.

It is not anticipated that the board will have much trouble in collecting assessments. The Act provides for such cases in two ways. The board is given power to levy an additional percentage upon an employer for default in payment, and may also collect through the courts by the simple process of issuing a certificate, stating the amount due, a certified copy of which, when filled with the clerk of any district or country court, becomes an order of the court, and may be enforced as a judgment.

INTERNAL STRESSES IN FORGINGS

H. V. WILLIE, of the Baldwin Locomotive Works, Philadelphia, has published particulars of a series of experiments conducted upon two 10 in. driving axles about 6 ft. long, for the purpose of determining the internal stresses in forgings after heat treatment. The axles were hollow bored with a 3 in. hole and were heated to 1500 deg., quenched in oil, and then immediately removed to an annealing furnace and annealed at 1200 deg. The object of these tests was to determine the magnitude of stresses in the axles due to heat treatment.

All conclusions derived from the experiments must be used conservatively, on account of the small number of tests. Nevertheless, it would appear that the heat treatment had a much greater effect upon a vertically quenched than upon a horizontally quenched axle.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

Question.—A slide valve is 10 inches long and 12 inches wide. The steam pressure is 120 pounds per sq. in. What size valve stem is required?

Answer. — Area of valve face is $10\times12=120$ sq. in.

Total pressure on valve is $120\times120=14{,}400$ pounds.

For iron to iron the co-efficient of friction is 0.15.

The power required to move the valve is, then, $14{,}400\times0.15=2{,}160$ pounds. By using a very low valve for the working stress, such as 3,000 pounds per sq. in., we may regard the valve stem simply as a rod in tension. Hence the area multiplied by the stress must be at least equal to 2,160. Area rod $=\frac{2{,}160}{3{,}000}$

Diameter $=\sqrt{\frac{2{,}160}{3{,}000\times.7854}}=\sqrt{.9167}$ $=.957$ inch, or, say, 1 inch in diameter.

* * *

Question.—What size cold-rolled steel shaft would be required to transmit 760 horse-power at 440 r.p.m., there being plenty of bearings and a number of heavy pulleys?

Answer.—A good approximate formula for this purpose is, $d=\sqrt[3]{\left(\frac{H.P.\times55}{r}\right)}$ where d = shaft diameter and r=revolutions per minute.

Diameter required $=\sqrt[3]{\left(\frac{760\times55}{440}\right)}$ $=\sqrt[3]{95}=4.56$.

* * *

Question.—A friction clutch contains a ring of oak which works against a flat cast iron surface. The outside diameter is 18 inches and the inside diameter 14 inches. The power to be transmitted is 42 horse-power at a speed of 220 r.p.m. What should be the pressure between the oak and the iron surfaces?

Answer.—The mean diameter of the friction ring is $\frac{18+14}{2}=16$ inches, or radius $=8$ inches.

The number of foot pounds $=42\times33{,}000=1{,}386{,}000$.

Speed of friction surfaces $=220$ r.p.m. or $\frac{16}{12}\times3.1416\times220=921.536$ feet per minute.

The rotative force required is $\frac{1{,}386{,}000}{921.536}$ $=1{,}503$ pounds.

The co-efficient of friction between oak and cast iron without lubrication is approximately 0.62.

The direct pressure required between the surfaces is $\frac{1{,}503\times100}{62}=2{,}424.2$ pounds.

* * *

Question.—A crane winding drum is 4½ feet long, 38 inches in diameter, and carries a double ¾-inch cable, which works over one double and one single block. How high could the load be lifted?

Answer.—The diameter of the drum is 38 inches. The mean diameter of one loop of cable is 38.75 inches. Circumference=$38.75\times3.1416=121.737$ ins.

Number of loops $=\frac{54}{2\times.75}=36$. The drum, then, will hold $\frac{121.737}{12}\times36=$ 365.311 feet.

There being four cables, the length of hoist is $\frac{365.311}{4}=91.3$ feet.

* * *

Question.—An aeronaut going at the rate of 90 miles per hour drops a bomb from a height of 3,000 feet. How long will the bomb require to reach the earth? How far behind the position vertically over the mark must he let go the bomb in order to hit it?

Answer.—The time required by a body to fall through a given height is equal to the square root of twice the height, divided by 32.16, or, time=$\sqrt{\frac{3{,}000\times2}{32.16}}$ $=\sqrt{186.567}=13.66$ seconds.

The bomb has a horizontal motion of 90 miles per hour $=\frac{5280\times90}{60\times60}=132$ feet per second. The distance travelled in 13.66 seconds is $13.66\times132=1{,}803.1$ feet.

* * *

Question.—What air pressure must be endured by a diver while working in 110 feet of water?

Answer.—A column of water a foot high and a square inch in cross section weighs $\frac{62.5}{12\times12}=.434$ pound. Pressure under 110 feet is $110\times.434=47.74$ pounds per sq. in.

This plus the atmospheric pressure = $47.74+14.7=62.44$, which is $\frac{62.44}{14.7}$ $=4.247$, or about 4¼ times the atmospheric pressure.

* * *

Question.—A steel band, 20 inches inside diameter is to be shrunk on a hub. .020 inch is allowed on the hub for shrinkage. To what temperature will the band have to be raised in order to enlarge the amount of the shrinkage? If the band be raised to a low red heat, what would be the difference in diameter between it and the hub?

Answer.—Co-efficient of expansion for steel is .00000599. For most accurate results the mean diameter of the band should be used. For our purposes we will use the inside diameter.

Circumference of 20-inch circle $20\times3.1416=62.832$. Circumference of circle, 20.02 inch in diameter is $20.02\times3.1416=62.8948$ inches. Expansion is $62.8948-62.832=.0628$ inch, which is $\frac{.062832}{62.832}$ $=.001$ of its whole length.

For every degree rise in temperature steel expands .000005.99 of its length. Temperature rise required then, is, $\frac{.001}{.000005.99}=166.9$ degrees, so that if the room temperature were 90 deg. F., the band should be heated to a temperature of $90+166.9=256.9$ degrees F.

Low red heat is about 975 deg. F., or a rise of $975-90=885$ deg. $885\times.000005.99=.00530115$. Expansion in circumference is $62.832\times.00530115=.33308$ inch.

Expansion in diameter $=\frac{.33308}{3.1416}=$ .10602 inch.

Difference in size $=.10602-.02=.08602$ inch.

Winnipeg, Man.—Hon. Robert Rogers announced just before leaving for the east last Thursday night that the Dominion Government had been instructed by the Russian Government to purchase for them in Canada 20,000 saddles at $72.50 each. This order will be divided among the saddle manufacturers of Canada.

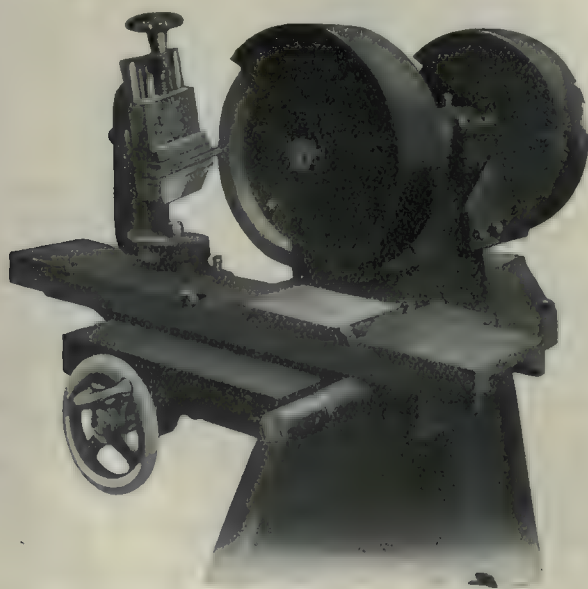
PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

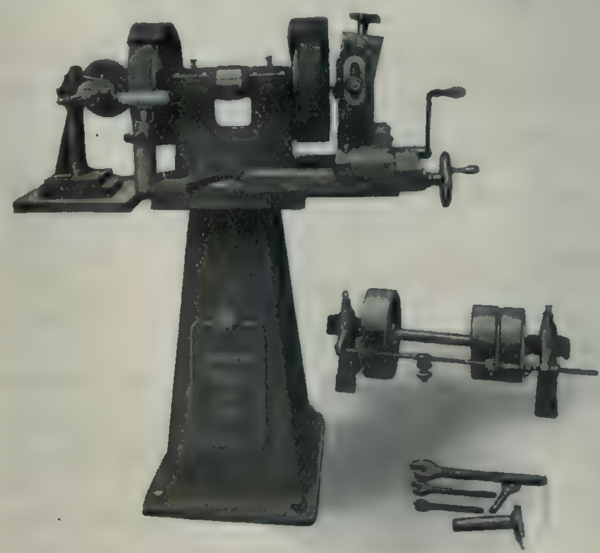
NEW CHASER GRINDER.

THE chaser grinder illustrated herewith has recently been perfected by the Landis Machine Co., Waynesboro, Pa., to meet the demands and requirements of the many users of thread-cutting dies, and more especially the well-known Landis die manufactured by the above company. The machine is of a duplex nature, in that it is fitted with an attachment for handling all sizes of Landis chasers, and a device to sharpen the disc cutters of roller pipe-cutting machines. It may also be used to grind lathe, planer, shaper, tools, etc.

The chaser grinding attachment has adjustment in both horizontal and vertical planes, with suitable graduations for controlling the lead and rake angles on Landis dies. Both the transverse and longitudinal feeds are in horizontal planes, a feature which insures very accurate grindings. A close inspection reveals the excellent design of the table which is gibbed at both slides and finished with an overhang to protect the guides from emery dust. The disc cutter grinding attachment is also adjustable vertically and horizontally and is operated by hand. An adjustable rest is likewise provided to facilitate the handling of miscellaneous tools.



LANDIS CHASER GRINDER.

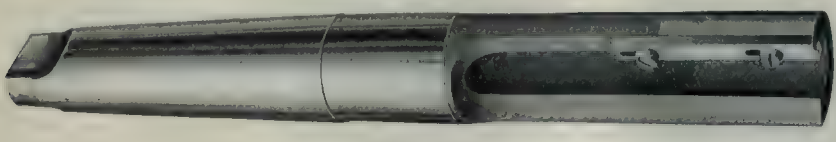


LANDIS CHASER GRINDER.

The rigid construction, guarded wheels and the ease with which the machine may be operated are features worthy of note, and together with its universal adaptability make it a most desirable equipment for the tool room.

A NEW CORE DRILL.

AMONG the small but very useful things about a testing plant will be a core drill recently brought out by the Triangular Tool Co., Erie, Pa. Nearly all manufacturers of steel and other metal products are required to take specimens from parts as designated by superintendents, owners and others. The getting of these specimens without a special appliance is altogether a costly and, in some cases, an impossible proceeding. There has not, we believe, been a thoroughly satisfactory tool for this purpose on the market, and any device that measures up to requirements should be well received.



CORE DRILL.

The drill is shown in the accompanying illustration. It is made of high-grade steel and has a No. 5 Morse taper shank. Two cutters are furnished with each tool, each capable with a reasonable amount of care, of removing from 100 to 150 coupons, depending upon the material. The time required to core out a single piece is given as from 15 to 25 minutes, which operation can be finished complete without removing the drill from the hole. New cutters can be bought at reasonable cost, and the body of the tool used indefinitely. Other uses of the tool besides the taking of specimens for tensile and cross-bending tests, will no doubt suggest themselves to the resourceful mechanic.

HIGH DUTY BALL-BEARING DRILLING MACHINE.

THE drilling machine shown in the accompanying illustration is known as the Avey No. 2½ High Duty Ball-bearing drilling machine, and is built by the Cincinnati Pulley Machinery Co., Cincinnati, Ohio. It is so designed that it may be operated full automatically, semi-automatically, or as a plain hand-feed machine. As a full automatic, the movements of the spindle are entirely under the control of the mechanism, and all that is required of the operator is to change the work under the spindle between strokes, operating as many spindles as the work will allow.

When arranged as a semi-automatic, all movements of the spindle except the engaging of the feed on the downward stroke are automatic. This is employed on work that requires a variable time for setting up. As soon as the work is fastened in position, the operator trips the feed lever, the hole is drilled, and the drill backs out of its own accord. The plain hand-feed is obtained by

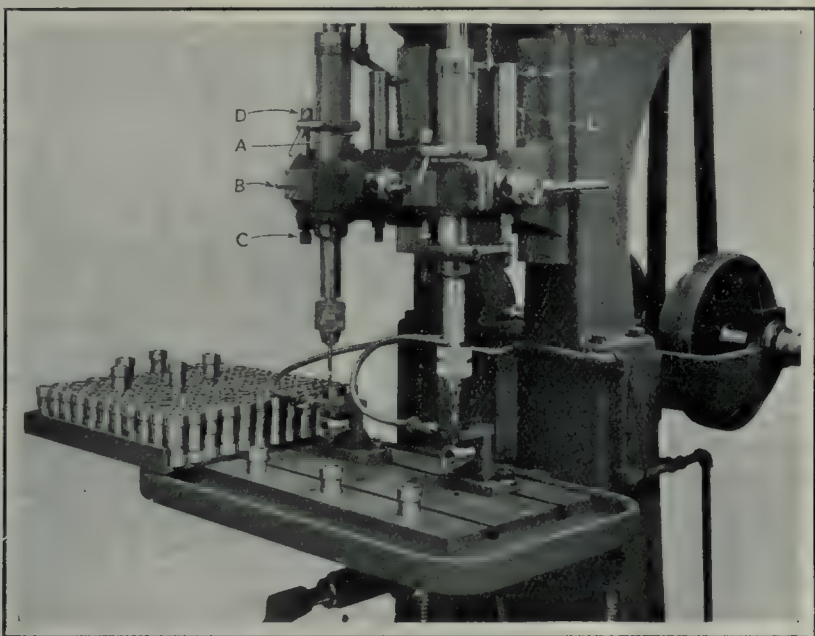
simply throwing out the automatic features. The hand lever is provided with a ratchet, which enables it to be placed in the most convenient position for operating, and can be instantly placed in the neutral position when it is desired to use the power feed.

The machine is entirely belt-driven, except the feed, which is driven by an enclosed worm. The pulleys, both on the spindle and on the countershaft, are extra large to give maximum pulling power, while the spindles are 1 inch diameter, and are ground to size. The spindle is finely graduated and fitted with a phosphor bronze stop collar, which serves as an accurate depth gauge. Four spindle speeds are obtained by shifting the countershaft cone, which is locked in each position by a ball plunger. The table elevating device consists of a double telescopic screw working against a ball thrust bearing and operated by a crank conveniently located. A steel rack is fitted between shoulders on the spindle sleeve for feeding and returning the drill.

The machine is fitted complete with ball-bearings. These are of the annular type, and are of standard sizes that may be purchased of all supply houses at competitive prices. Thrust bearings are also provided at both ends of the spindle sleeve. All are fitted with approved dust-proofing devices, which, along with the facilities for repairs, should give these machines a long life and low operating cost.

In the illustration, B is the lever for shifting the feed clutch by hand; D the adjustable tripping finger which regulates the depth of hole; C the lower tripping finger, which may be set to re-engage the feed clutch when the spindle returns; and A is the adjustable stop collar. At E is an air cylinder for the purpose of regulating and preventing jar to the returning spindle. This regulation is accomplished by means of the air relief cock at F.

These machines are furnished, if desired, with motor drive and lubricating tank and pump. They should cover a wide range of general manufacturing work, both in plants dealing with large and moderate quantities of component parts. This flexibility will allow of different jobs or various sizes of holes being drilled simultaneously on the multiple spindle machines, and they seem to be well suited both to the needs of piece and day workers.



NEW AUTOMATIC FEED DRILLING MACHINE.

DOMINION STEEL CORPORATION.

AT the close of last year there were some indications of a possible shrinkage in trade and of a reduction in industrial activity in Canada. During the earlier months of this year these conditions were more or less marked, but the operations of the Dominion Iron & Steel Co., Ltd., were kept about the average by orders received from Australia and South Africa. Later there came the promise of a renewal of activity in the shape of large contracts for rails and other materials required for the construction of the great railways and public works in the various parts of the Dominion, and orders for lighter forms of steel for general consumption.

Work on these had only well begun when war was declared, and general disruption of business arrangements ensued. For a time operations were reduced to a minimum, and the outlook was most discouraging. Efforts were made to secure market in Great Britain for some portion of the company's output and these were fairly successful. Operations have been gradually increased and the working force is now about two-thirds of the normal.

The output of the principal products during the year is approximately as follows:

	Tons.
Iron ore mined	335,000
Limestone quarried	295,000
Pig iron made	181,000
Steel ingots made	237,500
Rails made	120,000
Blooms & Billets for same	23,500
Wire rods made	37,700
Wire and wire products	26,000
Steel bars	15,000

NOVA SCOTIA STEEL & COAL CO.

THE business experience of the Nova Scotia Steel & Coal Co. for the year 1914, now closing, has been rather a checkered one, and perhaps in this respect differs but little from many other Canadian manufacturing establishments. The following figures indicate the output as compared with 1913:

Product.	1913.	1914.
Pig iron made	80,742	24,678
Ingots made	86,912	53,532
Pig iron used	72,204	43,649

The commercial depression which had overtaken Canada in the closing months of 1913, became very extended and deepened as the year 1914 progressed. Still the Scotia Company was able to keep all the furnaces in full operation until the outbreak of the war. It is true that the production of pig iron for the first half of the year was not as great as for the corresponding period of last year, but this was due to the blast furnace having been out for relining. The quantity of steel ingots made and pig iron used to produce them was greater than that of the corresponding period of 1913.

With the outbreak of war, in the early days of August, practically all business for a time ceased, and as the Scotia Company was carrying a large tonnage of ingots, it was deemed prudent to close down the blast furnace, open-hearth steel furnaces, and coke-oven plant, and on August 9, the blast furnace was banked, the open-hearth department closed down and all except one battery of coke ovens put out.

The placing of orders by the railroads of Canada for equipment was spasmodic and small, for the first half of the year, and after August 1 was practically nonexistent. Little business of any kind

was available either from the railroads, manufacturers, or elsewhere, and in consequence the mills of the Company were operated but a few days a week.

Making Shrapnel Shells.

About the middle of September a demand arose for steel for shrapnel shells. Fortunately the Company was in a position to supply this material. Exhaustive tests at the Dominion Arsenal and elsewhere established that Scotia steel was eminently suitable for and met, indeed more than met, all the requirements of the War Office. Since that time considerable quantities of shell material have been ordered. One open-hearth furnace has been working on this material continuously for some little time, being operated on cold pig of which a quantity remained on hand on the closing down of the furnace in early August.

Further orders have been received from the War Office for shell material, and the stock of suitable pig iron having been exhausted, the blast furnace was again burdened and put in blast on Monday, Dec. 28. A second open-hearth furnace has also been turned on to this material.

Output 3,000 Shells a Day.

The Company's New Glasgow forge was called on to produce forged shrapnel shell blanks. This was entirely new business, but native talent, energy and the experience gained in other forms of forging surmounted all the initial difficulties, and for weeks past the hydraulic presses have been turning out upwards of 3,000 shells a day. These are being shipped to engineering firms finishing the shells, at Montreal Sherbrooke, Toronto, Hamilton, Galt, etc. Up to the present time, something like 150,000 forged shell blanks have been delivered to the order of the Shell Committee and shipped to the various points named, also a corresponding number of steel shell discs forged from special high-carbon alloy steel. During the next three months the Company expect to supply about 400,000 more shell blanks and discs.

Orders from Great Britain.

Believing that opportunity offered for securing some export business, the Company dispatched one of its most energetic salesmen to Great Britain. His efforts resulted in securing orders for a very considerable tonnage of heavy marine forgings; indeed, the orders booked for this class of material within the last few weeks have been equal to the entire output of this class of work during the past twelve months. The securing of this work was due entirely to the Company having installed a hydraulic fluid compression plant at Sydney Mines, together with heavy hydraulic forging equipment at New Glasgow. This installation put the Scotia Company in the forefront of establishments of its kind in the Empire.

Recognition by Lloyd's

The product of the Scotia plant is recognized by Lloyd's as equal to the production of the best British or Continental forges, having met fully their specifications and tests. It would appear, therefore, as though a new market of considerable value has been opened up and promises well.

Owing to the closing of the German markets by the war, and the closing down of many blast furnaces in Britain due to uncertainty as to the future, coupled with utter stagnation of the iron trade in the United States, it became necessary early in August to close down the Wabana mines. While ore shipments abroad up to that time were almost on a par with the corresponding period of 1913, the shipments as a whole for 1914 are less than one-half of that of normal years. During the last few weeks some considerable tonnage of ore has been sold for delivery in Great Britain during the coming summer.

Coal Output Falls Off.

Owing to the closing down of the blast furnaces and the open hearth plant, the colliery output was somewhat restricted during the last five months of the year, and as a result the output is about 100,000 tons below 1913.

The consumption of coal in the Company's operations was of course very much less; on the other hand, the shipments to the St. Lawrence were about 30,000 tons greater than during 1913; while the shipments to the Maritime markets were practically the same as the previous year. Banking of coal during the winter will probably be on a comparatively restricted scale as compared with former winters. It is too early to make any definite forecast as to the coal trade for 1915.

Signs of Improvement.

As to the iron and steel business generally, there are not wanting signs of improvement; more tonnage has been booked during the past few weeks than for months past, and although prices are exceedingly low, any tonnage available is eagerly welcomed.

Every effort possible is being made to keep the mills and forges of the Company in operation, one outstanding encouraging feature being that Canada is undoubtedly now getting an opportunity to supply large quantities of foodstuffs and many lines of manufactured material. Some of this new business will probably cease with the close of the war. On the other hand, new markets for Canadian products are being opened up which, if Canadian manufacturers rise to the measure of their opportunities, will, however, be permanently retained to the great advancement and material benefit of the Dominion.

C. P. R. NORTH BAY DIVISIONAL SHOPS.

INSPECTION of the enlargement of the Canadian Pacific Railway Co. divisional shops at North Bay, Ont., shows how extensive the alterations and extensions are. Work on these was commenced early in 1913, and required about a year to complete. The project included not only the extension of the shops but also the mechanical yards, involving the reclamation of a small section of land along the shore of Lake Nipissing.

The motive power department prior to the change, consists of a 23 stall locomotive house, with small machine and blacksmith shop attached to the west end. This combined building was of heavy masonry construction, and has been retained in the new layout. To the west, however, there has been added a combined machine and erecting shop, served by a transfer table, along the west frontage of the shop. The erecting shop contains 10 tracks its depth being 70 feet. The normal monthly repair and overhaul output is eight locomotives.

ELECTRO-PERCUSSIVE WELDING.

A PAPER on Electro-percussive Welding, by C. E. Skinner and L. W. Chubb, was presented at the twenty-six general meeting of the American Electro-Chemical Society, held on October 12 and 13, at Niagara Falls. The paper states that, in the process of electro-percussive welding, two wires are welded together by causing a condenser discharge to pass between the ends of the wires at the moment when they are pressed together by mechanical force. The generation of the heat is so localized, so sudden, and so intense, that there is no time for unequal heat conduction through the shanks of the wire, and the ends will be melted and even vaporized whether the melting point is high or low. For this reason, metals of different kinds can be welded together independent of their electrical resistance, melting point, or heat conductance.

Any combination of metals which has ever been tried will weld together, but the joints will not be permanent with such combinations as aluminium and tin, or lead and iron. Electrically, the weld is complete in 0.0012 second, and although 23 kilowatts are being dissipated between the ends of the wire at a certain instant, the total energy used at the weld is about 0.00000123 kilowatt-hour, or enough to light an ordinary 50-watt 16 candle-power lamp for 0.09 second.

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Vol. XIII. JANUARY 7, 1915 No. 1

PRINCIPAL CONTENTS.

EMPLOYEES' WELFARE.

THE year just passed has been notable for the adoption throughout Canada of a number of Acts for workmen's protection and compensation in case of injury or death through accident in the course of their employment. Although these and similar legislation tend to make employees' welfare, to a certain extent, a legal necessity on the part of employers, the sphere in which the latter may show their personal consideration for their work people is not narrowed to any appreciable extent.

Much of the legislation referred to, notably the recently passed Province of Ontario Act, has been indirectly adopted from Germany and may yet require considerable amending before it will work smoothly under Canadian conditions. The objections so far urged come from the manufacturers, and are expressed in the matter of excessive and unequitable assessments. This difficulty has been partly overcome in New York State by a system of refunds, care being taken to so arrange the final assessment that the employer feels directly the result of extra effort in the care of the people in his employ. One aspect of employees' welfare work however, will be entirely changed by the present legislative enactments.

Steps taken and money invested in the preservation of the health of workmen and in reducing the hazard of their daily work have heretofore resulted in direct profit to the enterprising manufacturer. Provincial and national law will now make this a general condition attached to manufacturing and constructive business in Canada, and while the welfare of employees must, more than ever, be the result of personal thought and good-will on the part of their employers, it is not to be expected that as direct financial results will accrue to the latter as heretofore. There is, however, a vast field of activity in this direction open to the leaders of large corporations such as the provision of good homes, education, and the creation of healthy moral surroundings. These humanitarian branches of the employer's responsibility, while not yielding a financial profit, contribute immeasurably to the "holding" of workmen, the indirect importance of which has only recently been realized.

There have come to our notice several workman's benefit associations, but generally the only connection these societies have with the officials of the company organization is that the treasurer withholds from the pay envelopes each week or month the assessment for the benefit funds and which he turns over to the benefit society treasurer. The association is administered entirely by officials elected from among the employees and in some cases has been a far-reaching success. The greatest drawback, and in one instance the cause of failure has been the tendency of foremen to give the society little thought when hiring new help. Instead of taking on men more or less after the manner that insurance companies accept risks, they are inclined to hire those who may even be cheap on account of the lack of physical stamina. This eventually must tend to bring a heavy tax on the resources of the mutual benefit society. The most successful institution of this kind of which we have heard is that in which evidence of official interest is apparent by each member of the firm being assessed a monthly amount considerably in excess of that paid by the individual employees.

The welfare scheme that produces the best results and develops the greatest harmony between employers and employed is, and will always be the one that recognizes the personal element of good-will. Few managers realize that a Christmas present, if presented personally would be in every case worth many times more to both him who gives and him who receives, than if otherwise distributed. The director, shareholder or working official to-day who has not time to consider the welfare of his employees is like a mechanic who has no time to sharpen his tools, or the salesman who is too busy to brush his clothes.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 40
Lake Superior, charcoal, Chicago	15 75
Ferro Nickel pig iron (Soo)	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00
Hamilton, No. 1	18 00	17 00
Hamilton, No. 2	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 75
Copper, crucible	10 00	9 75
Copper, unch-bled, heavy	9 50	9 75
Copper wire, unch-bled	9 50	9 75
No. 1 machine compos'n	8 50	8 75
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$14 00	$14 00
Electrolytic copper	13 75	13 75
Castings copper	13 50	13 50
Spelter	6 00	6 00
Tin	37 00	36 00
Lead	4 85	5 00
Antimony	16 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
	X Strong	P. E.		
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
	XX Strong	P. E.		
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.56
Linseed oil, boiled, single bbls.	0.59
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 08
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 4, 1915.—On account of the holiday season there was but little activity in the iron and steel market throughout the week, the general dullness before prevailing having been accentuated by the festivities of the last ten days. As we cross the threshold of 1915, many factors present themselves from which the business trend of the first quarter of the year may be anticipated. On all sides we are hearing of the "boom" which is to follow the declaration of peace, and that such a "boom" is bound to come sometime in the future, no one for a moment questions. Peace, however, is not in sight and what concerns us most meantime is what the immediate future has in store. Toward the latter part of the year just completed, business conditions had commenced to improve. The lowest level appears to have been reached and we are now on the upward trend. We are at the moment of writing in the throes of a rather severe winter, during which season in any case the majority of our industries experience a slack period. Taken altogether, we are now passing over and leaving behind, the very worst possible combination of circumstances. As the year progresses, there is no doubt that improvements in all lines will be noted. In many industries, such as woolen mills, shoe factories, etc., great activity is being experienced; in fact, a great variety of industries are actively engaged in fulfilling orders for war supplies to the exclusion of other work.

The Steel Market.

At present the greatest activity in the steel trade is in the manufacture of munitions of war. The manufacture of shells seems to be the main feature in many plants. Some firms have purchased new machines for rapid and economic production of this specialty, while others have re-arranged their equipment in order to facilitate the handling of such work. Most of the forgings for the shells are being made in Canada.

In the United States it is expected that the railway interests will be more or less extensive purchasers of steel, due to the adjustment of the freight rates

and improving business conditions. This activity will no doubt be reflected in the Canadian channels. Neither machinery steel nor structural sections are in demand. The new Armstrong-Whitworth Plant at Longueuil, P.Q., will put its various lines of product on the market during the winter..

Pig Iron

Conditions surrounding the pig iron market have not changed. There is little or no business moving as the foundries are doing very little. Prices remain about the same because there is not enough business passing to test them.

Machine Tools and Supplies.

Machine tools have not been the subject of much inquiry, while supplies have only been in moderate demand.

Metals.

In the metal market business also has been quiet and prices have not changed.

Toronto, Ont., Jan. 5, 1915.—The past week has been, as is usual at this time of the year, a quiet one in business circles, and consequently there is nothing of particular interest to report. The dullness has perhaps been more pronounced than in previous years on account of aggravation by the war. While conditions generally are fundamentally sound, there is a continued tightness in the money market and a marked tendency to be cautious in business operations. There is some uncertainty as to industrial developments in the near future, although indications point to an improvement in trade by the spring. To what extent this optimism is justified remains to be seen. There is no doubt, however, that although the opening of the New Year finds trade generally quiet, except in the case of factories working on war orders, the outlook for the future is bright in Canada. There will be a continued restriction in the volume of trade for the next few months, but this will gradually become less noticeable as time goes on. The Government propose to continue operations on public works, but curtailment will be made in those of lesser importance, a necessary step on account of the falling off in revenue and the great expense entailed in furnishing equipment for the various overseas contingents.

Steel Market.

Dullness prevails in the iron and steel trades at the commencement of the New Year. The dislocation in the steel trade, partly caused by the war, has not entirely been adjusted, although in some districts there are signs of revival in varying degrees. From Hamilton and Sidney come reports of increased business, which it is to be hoped will develop into something substantial. During last year the steel trade was in an unsatisfactory condition, partly due to the war, but principally owing to the industrial depression and the falling off in railway construction and in building operations. While ordinary trade conditions will, no doubt, improve before long, the same can hardly be said of railways and the building trade, because of financial considerations.

Machine Tools.

Continued dullness prevails and conditions in the market are uninteresting. The present financial situation is no doubt responsible for this dullness, as a number of projects have been held up.

Metals.

The metal markets are very dull this week, although some improvement may be expected now that the holiday season is over and industrial plants have resumed more active operations. Prices are unchanged all round, and there is a general quietness. The export copper situation is still unsatisfactory, large quantities consigned to neutral ports being still held up. The tin market is weak and unsettled. Spelter is firmer, and lead also continues firm with better inquiry. Aluminum is dull, but antimony is firm and developments are possible.

C.P.R. FREIGHT TERMINAL AT QUEBEC.

BY the early spring of 1915, if all goes well, the Canadian Pacific Railway will have completed at Quebec, the work of construction which is being done by Downing-Cook under the direction of D. H. Mapes, supt. C. P. R. Building Construction, has progressed in a most satisfactory manner, and what was once only a section of the C. P. R. yards with its network of tracks has been transformed into the foundations and frame work of this proposed structure.

The foundations and floors of the two sheds, one for inbound freight and the other for outbound, are of reinforced concrete, while the structure itself is supported by steel rafters and girders. All foundations are on Raymond concrete piles. The inbound shed is 50 ft. wide by 600 ft. long, while that for goods outward measures 30 ft. wide by 300 ft. long. A transfer platform lies between both sheds, and tracks have been laid in such a manner that the freight cars may be shunted alongside both platform and shed. Another decided innovation, and one of much convenience to merchants, is the system of doors to be arranged. These sliding doors are continuous the full length of both track and roadway sides of the shed, and will be so installed and manipulated that an entrance to the shed may be effected at any particular point, therefore loading or unloading of goods will be greatly facilitated, and the time consumed lessened.

Both sheds or terminals are constructed on a system of units, that is to say, each shed will be so erected that, if necessity requires, it may be lengthened by the addition of further units. The structure will be absolutely fireproof and the cost of erection will amount to approximately a quarter of a million dollars. Some 115 men are employed at present; mostly local labor.

April 15 of next year is the date set for the completion of this contract, as it is the intention of the C.P.R. to erect a new station, the work on which will likely commence around that date, thus necessitating the demolishing of the old freight building on which site the erection of the new station is contemplated.

It is the intention of the railway people to have a freight terminal which will be modern in the strictest sense, therefore all the latest ideas of American and Canadian freight experts have been moulded together with that end in view. The structure will be fronted with a two-storey office building, 50 ft. by 100 ft., for the staff, and, through this, access to the sheds may be gained by those having business there. A complete installation of electric lighting and plenty of windows ensure excellent artificial and natural lighting. S. G. Newton is superintending the work in the interests of the W. S. Downing-Cook.

The terminals were designed by the building and construction dept., of the C. P. R. The steel work was planned by P. B. Motley, C. P. R. engineer of bridges. The steel used in construction will be furnished by the Dominion Bridge Co., of Lachine, and Douglass Bros., of Montreal, have the roofing and door contracts. The painting is in the hands of Schulmerick & Co., Montreal, and the brick work is to be cared for by the Citadel City Brick Co., of Quebec.

EASTERN CAR COMPANY.

New Freight Car Orders in 1914.

Name of Road or Company—	No.	Class	Capacity.	Car Body Wood, Steel or Steel Frame.	Underframe Wood, Composite or Steel.	Draft Gear Spring or Friction.
M. A. Hanna & Co.	2	Mine	100,000 lbs.	Steel	Steel	Spring
Intercolonial Ry.	180	Box	80,000 lbs.	Steel Frame	Steel	Spring
Intercolonial Ry.	4	Pit	150,000 lbs.	Steel	Steel	Spring
Intercolonial Ry.	250	Gondola	100,000 lbs.	Steel	Steel	Friction
Total	436					

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

BRITISH COLUMBIA AND THE PAN-PACIFIC EXHIBITION.

ACTIVE preparations are under way at the Provincial Agricultural Department for the exhibit which the British Columbia Government will make in conjunction with the Canadian Pacific Ry. at the Panama-Pacific Exposition to be opened at San Francisco on February 1. W. A. Laing, Exhibition Commissioner, will leave for San Francisco shortly to superintend the arrangements for the display, which will include exhibits illustrating the resources of British Columbia in minerals, timber, fish, fruit and general farm products, all of which being shown to the best advantage, will be bound to attract a great deal of attention and prove a magnificent advertisement for the Province. By combining with the railway company, a more effective display will be possible than by making a separate exhibit. Shipments are now being prepared and specimens of British Columbia lumber, fish, game, fruit and minerals will be forwarded before the end of the year.

The Government is sharing the large lecture room of the C. P. R., and a special feature of the exhibit will be the showing of a complete set of the cinematograph films taken during the past year for the Government, a few of which have been finished in Victoria, the remainder being sent to London to be developed and printed by the Kineto Co. to ensure the best possible results being secured. These films depict the following subjects:

Scenes illustrating the lumbering and salmon industries of the Coast, gill-net fishing, purse seine fishing, trap fishing, livestock at the colony farm, the departure of the first contingent for the front, the train of B. C. salmon donated to the Mother Country leaving Vancouver, vegetable growing at Armstrong, local scenes, fruitgrowing and the B. C. Horse drilling.

These films, through the medium of J. H. Turner, Agent-General for the Province, will also be shown throughout Great Britain and other European countries.

NEW U.S. FREIGHT RATES.

SCALES of rates to be used in making the general increase of 5 per cent. in class rates recently granted the Eastern Railroads by the Interstate Commerce Commission have been submitted to the Commission by C. C. McCain, chairman of the Trunk Line Association Committee.

To points intermediate between New York and Chicago, taking 71 per cent. and higher of the New York-Chicago class rates, the new tariffs will become effective on January 15 and, to points taking a lower percentage of the rates, they will become effective February 1.

The first-class rate between New York and Chicago will be 78.8 cents per hundred pounds, and the other five classes will be graded proportionately lower.

To Canadian destinations, the first-class rate from New York will range from 59.9 cents to 78.8 cents per hundred pounds, and it will be the same from Philadelphia and Baltimore. From Albany to Canadian points, the first-class rate will range from 44.1 cents to 63 cents, and from Syracuse and Rochester from 41.9 to 55.2 cents. The tariffs provide that from New York to all Canadian points, via People's Line steamers and rail via Rouse's Point, N. Y., not less than standard all-rail rates shall apply.

To points taking higher than 78 per cent. of the class rates on traffic moving by way of Long Island Sound, New London, Conn., or Boston or Portland, Me., a differential of eight cents per hundred

CANADIAN TRADE STATISTICS

IMPORTS FOR CONSUMPTION—Twelve Months Ended October.

	1911.	1912.	1913.	1914.
Dutiable goods	$307,804,520	$404,163,959	$448,967,191	$327,479,486
Free goods	179,653,076	211,456,015	225,346,035	187,106,428
Total imports, merchandise	$487,457,596	$615,619,974	$674,313,226	$514,585,914
Coin and bullion	16,682,212	16,290,174	5,813,365	92,855,571
Total imports	$504,139,808	$631,910,148	$680,126,591	$607,441,485
Duty collected	80,582,880	105,466,608	116,458,689	87,897,619
EXPORTS—				
Canadian produce:—				
The mine	$ 43,571,950	$ 51,461,843	$ 58,123,916	$ 56,477,255
The fisheries	16,417,087	16,219,337	19,204,369	19,217,145
The forest	40,795,608	43,353,926	42,749,039	42,621,760
Animal produce	51,648,813	43,759,806	46,803,704	63,984,270
Agricultural products	88,116,117	132,191,415	186,892,558	164,772,083
Manufactures	34,341,139	40,469,492	51,201,279	65,454,730
Miscellaneous	192,198	93,037	116,916	268,863
Totals, Canadian produce	$275,082,912	$327,548,856	$405,091,781	$412,796,106
Foreign produce	17,543,767	20,487,005	24,836,170	46,467,035
Total exports, merchandise	$292,626,679	$348,035,861	$429,927,951	$459,264,141
Coin and bullion	7,486,900	11,840,665	17,228,157	19,862,690
Total exports	$300,113,579	$359,876,526	$447,156,108	$479,126,831
Aggregate trade	$804,253,387	$991,786,674	$1,127,282,699	$1,086,568,316
IMPORTS BY COUNTRIES—				
Australia	$ 474,800	$ 361,414	$ 626,013	$ 466,389
British Africa	395,847	390,550	521,983	458,523
British East Indies	4,586,054	6,162,864	7,177,582	5,911,998
British Guiana	4,433,290	4,276,884	3,340,373	3,900,366
Brit. W. Indies, including Bermuda	5,693,852	6,514,770	4,135,360	6,046,423
Newfoundland	1,755,243	1,928,878	2,090,788	1,388,215
New Zealand	791,997	2,174,671	3,205,960	3,669,245
United Kingdom	111,209,763	130,368,304	143,219,531	106,019,715
Other British	887,581	1,069,723	1,488,745	2,237,212
Argentine Republic	2,188,584	3,703,410	3,157,431	3,655,052
Belgium	3,576,382	3,725,057	4,663,864	3,272,054
France	11,415,688	14,401,297	14,948,692	11,567,424
Germany	11,085,599	12,873,722	15,640,438	9,927,765
Holland	2,331,884	2,826,626	3,105,839	2,337,328
Japan	2,382,012	3,481,113	2,728,420	2,519,357
United States	323,989,540	412,657,022	442,341,840	421,074,528
Other Foreign	16,941,782	24,903,848	27,733,732	22,989,891
EXPORTS BY COUNTRIES—				
Australia	3,863,535	$ 4,137,192	$ 4,459,546	$ 5,500,288
British Africa	2,675,720	2,980,290	3,800,753	4,809,132
British East Indies	214,120	395,645	637,510	687,445
British Guiana	583,266	639,897	614,359	627,068
Brit. W. Indies, including Bermuda	4,419,762	4,741,317	4,552,757	4,889,769
Newfoundland	4,256,451	4,390,548	4,833,180	4,883,715
New Zealand	1,044,554	1,579,970	2,011,430	2,002,422
United Kingdom	139,551,778	167,758,351	212,467,641	204,819,891
Other British	800,476	612,017	1,902,144	1,696,898
Argentine Republic	2,792,731	2,857,188	2,308,754	738,773
Belgium	3,127,973	4,129,138	5,955,990	3,534,506
France	2,493,195	2,396,518	2,849,435	8,938,234
Germany	2,975,862	3,849,052	3,807,405	3,994,877
Holland	1,557,439	2,382,472	5,594,090	5,830,129
Japan	486,885	738,502	1,507,150	1,261,075
United States	119,747,951	145,721,650	179,050,796	213,493,406
Other foreign	9,521,881	10,566,779	10,803,168	11,419,203

pounds lower than the standard all-rail rate is established with proportionately lower differentials on other classes.

U.S. ARMS SHIPMENTS TO BELLIGERENTS.

IN response to Senator Hitchcock's resolution in the U.S. Senate, for information on shipments of war munitions from the United States, Secretary Redfield submitted on December 19, a report giving data so far available. There are 15,000 firms in the country, he said, that could export munitions, and it had been impossible to make a complete investigation.

Heaviest shipments of ammunition since the war began were in October, chiefly to the United Kingdom and France. For that month munition exports to them totalled $1,104,744 worth of cartridges, $539,360 worth of firearms and $1,114 worth of gun-powder. Since the war began there is no record of shipments of war munitions to Germany, Russia, Belgium or Servia.

Germany was a heavy buyer of cartridges and firearms in 1913, and a heavier buyer in 1914, but has taken none since the war began. Russia bought sparingly in 1913, the total value being less than $9,000, but in 1914 it rose to $750,000 worth of cartridges and firearms. She has taken none since the close of the fiscal year 1914 on July 1.

The United Kingdom took nearly $200,000 worth in the fiscal year ended June, 1913, and about $200,000 worth in the fiscal year ended June, 1914. She bought a little over $30,000 worth in August, nearly $300,000 worth in September and nearly $800,000 worth in October.

Canada was a heavier buyer. In the fiscal year ended June, 1913, Canada took $1,300,000 munitions of war, and the following fiscal year nearly $1,000,000. In August, after the war began, about $100,000; in September, about $80,000 worth, and in October about the same amount.

CANADIAN TRADE STATISTICS

ARTICLES IMPORTED—Twelve Months Ended October.	Total 1913	Total. 1914	From United Kingdom. 1914	From United States. 1914
Ale, beer and porter	$ 1,412,021	$ 1,004,076	$ 335,303	$ 641,080
Animals, living	2,998,076	1,733,193	150,681	1,462,296
Books, periodicals, etc.	6,732,189	6,504,195	1,380,661	4,788,613
Breadstuffs	11,207,569	11,459,160	792,544	7,916,180
Bricks, tiles, clays and mfrs. of	3,460,037	2,593,218	345,050	2,240,541
Carriages, carts, wagons, cars, etc.	22,845,506	12,489,189	552,006	11,859,197
Cement	659,926	191,273	44,622	135,691
Coal, coke, etc.	49,767,757	43,943,800	150,075	43,762,738
Cocoa, chocolate, etc.	2,580,941	2,428,554	1,053,814	648,012
Coffee	2,622,409	2,276,451	213,991	204,455
Cordage, rope and twine	4,085,363	3,632,261	455,886	3,171,609
Cottons	38,946,994	33,171,101	14,654,253	16,350,248
Curtains	697,080	493,378	349,095	97,269
Drugs, dyes, chemicals, etc.	16,256,618	14,148,259	2,568,321	8,008,015
Earthenware, china and graniteware	3,425,768	2,431,896	1,405,463	489,385
Electric apparatus	10,033,552	7,435,949	855,431	6,231,439
Fancy goods	5,043,959	3,992,270	1,539,655	1,086,370
Fish	2,435,251	1,988,891	235,864	630,661
Flax, hemp, jute and mfrs. of	9,479,985	7,089,743	4,139,526	758,429
Fruits	16,923,059	16,866,324	867,575	13,108,307
Furs, skins and mfrs. of	6,563,887	2,704,410	505,603	1,593,384
Glass	5,693,732	3,880,465	1,053,466	1,683,944
Gloves and mitts	2,858,698	2,126,727	876,024	267,084
Grasses, fibres and mfrs. of	2,373,212	1,986,866	46,412	1,682,247
Grease	1,080,658	1,132,034	18,344	1,101,554
Gunpowder and explosives	1,298,268	1,167,018	455,514	671,519
Gutta percha, India rubber, and mfrs. of	10,773,348	7,764,972	2,022,573	5,453,959
Hats, caps, bonnets, etc.	6,006,883	4,665,044	2,027,318	2,117,977
Hides and skins other than fur	10,495,575	10,736,744	662,861	2,881,530
Leather and mfrs. of	9,346,764	7,783,416	1,518,610	6,202,062
Metals, minerals, etc., total	172,362,905	103,416,486	13,524,881	85,408,918
Brass and mfrs. of	5,223,062	3,311,293	331,765	2,829,418
Copper and mfrs. of	7,357,343	4,847,740	59,878	4,746,350
Iron and steel and mfrs. of	139,972,538	80,187,335	10,145,579	66,980,814
Tin and mfrs. of	7,368,797	5,233,970	1,235,410	3,840,074
Musical instruments	2,204,023	1,864,113	95,112	1,561,155
Oils	16,585,077	15,447,616	437,861	14,430,874
Oilcloth	2,628,466	1,804,220	1,373,662	420,734
Paintings, drawings, eng'vings, etc.	2,011,329	1,499,818	476,584	822,692
Paints and colors	2,407,768	1,761,858	531,796	990,019
Paper and mfrs. of	8,681,499	6,876,637	1,441,281	4,709,003
Precious stones	3,776,102	2,693,043	1,464,896	164,965
Provisions	11,468,830	8,570,989	544,493	5,518,265
Ribbons	1,724,810	1,859,635	701,560	174,665
Seeds	1,684,692	1,726,758	211,384	1,338,566
Settlers' effects	15,127,801	10,301,052	2,806,052	7,247,548
Silk and mfrs. of	9,688,307	8,839,384	3,045,978	1,549,017
Soap	1,341,409	1,220,643	141,142	917,419
Spirits and wines	7,107,930	6,518,309	3,102,213	115,407
Sugar, molasses, etc.	17,999,152	17,872,584	702,996	717,034
Tea	6,598,944	6,579,024	2,904,549	48,788
Tobacco	7,177,398	6,976,249	714,948	5,074,500
Vegetables	3,333,509	3,346,209	206,610	2,682,717
Watches	1,821,453	1,084,289	118,177	639,207
Wood and mfrs. of	27,678,829	19,122,036	454,731	18,017,693
Wool and mfrs. of	34,323,488	24,932,815	20,474,816	2,245,028
Total value of principal and other articles imported:—				
Dutiable goods	448,967,191	$327,479,486	$ 83,032,139	$194,152,060
Free goods	225,346,035	187,106,428	23,987,302	134,081,858
Total imports, merchandise	$674,313,226	$514,585,914	$106,019,441	$328,233,918
Coin and bullion	5,813,365	92,855,571	274	92,840,610
Total imports	$680,126,591	$607,441,485	$106,019,715	$421,074,528

ADDITIONS TO CONTRABAND LIST.

THE British Embassy at Washington made public on December 25 a complete list of the additions which Great Britain has made to her list of absolute contraband in the present war. This list contains many products never before reckoned as absolute contraband in any war, and will impose further restrictions upon American trade.

Great Britain's latest additions to the list of absolute contraband serve to emphasize more impressively than anything that has yet occurred her determination to throw overboard altogether the regulations of the Declaration of London in regard to the contraband. When the present war began she announced her intention of adhering as closely as possible to these declarations with a few exceptions. On her list of absolute contraband, as now made up, are many items not found in the Declaration of London.

Until the present war began, much headway had been made in the movement to restrict interference by belligerents with the trade of neutrals. The tendency seemed to be more and more to assert the principle that the rights of neutrals were to be protected. With the disregarding of the London Declaration it now seems to be the other way, and Great Britain apparently has started out to impose every restriction which will help to starve Germany into submission.

Materials for Explosives.

The additions to the contraband list are chiefly materials that might enter into the manufacture of explosives. Partly-wrought copper and copper wire are added to the list, and also rubber, sulphur, glycerine and zinc and lead ores. Unwrought copper already was on the list of absolute contraband, but the copper items probably will hit the United States as hard as any. Here are the additions to the list:

Ingredients of explosives—namely, nitric acid, glycerine, acetone, calcium acetate and all other metallic acetates, sulphur, potassium nitrate, fractions of distilled products of coal tar between benzol and cresol inclusive; aniline, methyaniline, dimethylaniline, ammonium perchlorate, sodium perchlorate, sodium chlorate, barium chlorate, ammonium nitrate, cyanamide, potassium chlorate, calcium nitrate, mercury.

Resinous products, camphor and turpentine (oil and spirit).

Ferro alloys, including ferro-tungsten, ferro-molybdenum, ferro-manganese, ferro-vanadium, ferro-chrome.

Tungsten, molybdenum, vanadium, selenium, cobalt, manganese.

Wolframite, scheelite, molybdenite, manganese ore, zinc ore, lead ore, bauxite.

Alumina and salts of aluminum.

Antimony, together with sulphides and oxides of antimony.

Copper, part wrought, and copper wire.

Submarine sound-signalling apparatus.

Tires for motor vehicles and for cycles, together with articles or materials especially adapted for use in manufacture or repair of tires.

Rubber, including raw waste and reclaimed rubber, and goods made wholly of rubber.

The conditional list stands as before, but sulphur and glycerine are transferred to the absolute list.

LONDON, ONT. HYDRO REPORT.

THE London Hydro Commission financial report for 1914, which has just been audited by Jewell & Dale, shows a splendid advance in earnings. In spite of the depression, the surplus at the end of 1914 operations is $72,789.11, being about double the surplus shown at the end of 1913, and this in spite of a 10 per cent. reduction in rates. The total revenue for 1914 was $269,851.80, as against $192.224.47. The profit on the year's operations in 1914 reaches $72,000 as against $45,000 for the previous year. The surplus would be sufficient to pay a 6 per cent. dividend on the common stock of a commercial company on a capitalization of $1,500.000, and still leave a surplus of $12.789.

A 30 Per Cent. Reduction

The returns given from London are for the year ending November 30, 1914. London rates were cut 10 per cent. in 1913, and 10 per cent. in 1914. In the recent announcement of the Ontario Power Commission, another 10 per cent. reduction was ordered. This means that London rates have been cut 30 per cent. since that city started to use Hydro power. The rates of London are at least 25 per cent. lower than the prevailing rates in Toronto. If the 10 per cent. reduction ordered by the Provincial Commission had been put into effect in Toronto, the rates in London would still be at least 15 per cent. lower than those of Toronto. Hydro officials say that the London rates are the cheapest in the world.

In 1912 London paid $28 per horse power for Hydro; in 1913 the city paid $24 per horse power and in 1914 the rate was $23. London had 6,407 consumers in 1913 and in 1914 this number was increased to over 7,000.

An increase of nearly 1,000 consumers in a year proves that rate reductions get business, and that the advice of the Ontario Commission was safe and sound.

MONTREAL CUSTOMS RETURNS.

A decrease of $6,473,099.29 was shown in the customs collections of the Port of Montreal for the present year, as compared with those of last year. While these figures are itemized finely, they have been estimated for the final three days of this year. but it is reckoned by R. S. White. Collector of Customs, that they are practically correct.

This is the first really big decrease in collections that has been shown by the Port of Montreal for many years. While the drop was steady, it showed a tendency to increase, the reduction during the past three months having been greater than during the earlier months of the year.

While the shrinkage in collections is very considerable, amounting to over $500,000 a month, it is not in itself a very serious thing, since it covers a large proportion of the trade of the Dominion. It really means that things have been thrown back to about where they were three years ago, when prosperity was in the air. The collections were about $5,000,000 less than those of 1912, and practically equal to those of 1911, while they were much in advance of the returns for previous years.

The reduction has naturally been attributed to the war, but it is stated that the present belligerent condition in Europe could not be altogether blamed for it. since the drop really began in the fall of 1913, long before anyone dreamed of the present troubles.

In July, 1913, Mr. White reported the greatest customs collections for any month ever taken in Montreal. amounting to $2.529.211. From that time the collections began to drop, until by November, 1913, they showed decreases from the monthly figures for 1912. During the present year they showed a steady tendency to shrink. until by August. the month in which war was declared. they

CANADIAN TRADE STATISTICS

ARTICLES EXPORTED—Twelve Months Ended October.	Total 1913	Total 1914	To United Kingdom. 1914	To United States. 1914
Animals, living—Total	$ 4,919,677	$ 13,427,269	$ 128,195	$ 13.096,875
Cattle	4,121,812	9,749,333	......	9,604,535
Horses	584,465	872,846	113,110	726,998
Sheep	95,241	181,985	4,000	169,520
Breadstuffs—Total	$150,797,726	139,558,810	109,763,651	14,460,203
Barley	6,541,161	5,101,193	3,979,553	633,801
Bran	1,496,703	1,531,927	33,191	1,386,897
Cereal foods	2,034,130	2,201,700	1,552,281	23,223
Oats	6,886,005	13,249,529	4,688,176	7,052,296
Oatmeal	628,745	458,803	433,653	13,000
Wheat	112,636,352	94,918,445	86,655,592	4,625,816
Wheat flour	20,044,701	21,453,704	12,376,412	246,149
Coal, coke, cinders and charcoal	4,440,599	4,305,756	95,976	3,047,224
Cordage, rope and twine	708,026	880,123	44,654	676,420
Fish—Total	18,638,513	18,781,072	5,640,348	7,583,241
Cod, etc., dry salted	4,885,532	4,061,574	48,404	1,413,394
Lobsters, canned	2,981,303	2,908,730	1,027,595	847,269
Salmon, canned	5,435,832	5,316,564	4,331,452	24,230
Fruits—Total	5,023,816	4,333,530	3,487,615	267,839
Apples, fresh	4,095,726	2,401,003	3,119,821	78,173
Furs, skins and mfrs. of	5,556,322	4,273,203	2,109,606	1,944,707
Hay	1,821,498	2,140,522	114,310	1,353,552
Hides and skins other than fur	8,359,700	8,442,660	12,241	8,412,434
Leather and mfrs. of—Total	2,277,888	5,106,880	1,508,530	3,441,170
Sole and upper	1,785,227	3,897,296	1,354,293	2,431,931
Metals, minerals, etc.—Total	66,166,148	66,667,353	15,727,225	40,058,515
Aluminum in bars, blocks, etc.	1,618,652	2,207,747	689,161	1,168,321
Asbestos	2,744,127	2,424,001	358,457	1,609,594
Copper	9,777,292	8,769,069	831,787	7,937,282
Gold-bearing quartz, dust, etc.	12,399,769	15,141,834	108,605	15,026,278
Iron and steel and mfrs. of	10,853,477	12,258,675	943,841	2,781,005
Nickel	5,010,480	5,486,939	1,485,551	3,963,325
Silver	20,775,166	17,024,355	10,630,499	5,379,435
Paper	10,157,701	14,795,874	556,222	12,627,021
Potatoes	942,157	927,916	70,003	290,234
Provisions—Total	25,305,135	31,915,666	25,355,586	5,976,004
Butter	280,378	522,031	104,344	230,409
Cheese	19,643,862	19,122,988	18,730,393	210,018
Meats—Bacon and hams	4,522,050	7,604,987	5,954,683	1,644,262
Seeds	27,164,556	16,453,112	3,322,929	12,887,295
Settlers' effects	2,567,775	3,326,215	302,524	2,896,500
Whiskey	1,032,587	1,051,675	25,761	868,625
Wood and mfrs. of—Total	49,202,785	52,013,587	11,614,624	37,960,878
Logs	760,947	771,505	35,588	735,581
Lumber—				
Deals, pine	1,279,219	1,367,516	1,302,346	48,063
Deals, spruce and other	6,371,394	5,788,234	5,182,493	533,448
Laths, palings and pickets	1,948,739	2,048,860	39,053	1,987,248
Planks and boards	20,148,389	19,456,066	1,494,897	16,484,684
Shingles	1,331,692	2,831,684	2,291	2,789,249
Timber, square	479,874	755,939	738,411	7,099
Wood blocks for pulp	7,130,459	6,707,921	......	6,707,921
Wood pulp	5,635,231	8,595,228	1,720,596	6,638,411
Total value of principal and other articles exported:—				
Canadian produce	405,091,781	412,796,106	182,261,924	183,011,450
Foreign produce	24,836,170	46,468,035	22,556,813	10,929,942
Total exports, merchandise	$429,927,951	$459,264,141	$204,818,737	$193,941,392
Coin and bullion	17,228,157	19,862,690	1,154	19,552,014
Total exports	$447,156,108	$479,126,831	$204,819,891	$213,493,406

only amounted to $1,941,356, while by December they had dropped to $1,300,-000. The lowest month of the year, and the lowest for many years, was October just past, when the collections only amounted to $1,229,438, not far from $1,000,000 less than for the same month of the preceding year.

Following is a comparative statement of the Customs collections at the Port of Montreal during the present year and 1913:

	1913.	1914.
Jan.	$2,097,181.22	$1,669,455.97
Feb.	2,036,478.99	1,674,816.99
March	2,245,650.49	1,729,949.03
April	2,113,086.72	1,571,255.19
May	2,396,076.60	2,012,153.47
June	2,334,887.46	1,820,282.94
July	2,529,211.19	1,787,232.26
Aug.	2,269,669.37	1,941,356.30
Sept.	2,133,701.42	1,510,630.53
Oct.	2,147,810.93	1,229,438.94
Nov.	1,909,077.35	1,317,616.37
Dec.	1,824,455.54	*1,300,000.00
Total	$26,037,287.28	$19,546,187.99
Decrease in 1914		$6,473,099.29

*Estimated.

ONTARIO MOTOR CAR TAX INCREASE.

ON December 30, the Hon. W. J. Hanna, Provincial Secretary, announced that the Ontario Government had decided to tax motor cars according to their horsepower. The license year of 1914 has been extended until January 31, 1915, in order to give the Provincial Secretary's Department time to get out the new schedule of rates. It is expected that the new license rates will provide an additional revenue of over $100,000. The revenue from motor licenses in 1914 was $149,210.45. The rate for motor vehicles announced by Mr. Hanna are as follows: 25-h.p. or less, $6.00; more than 25-h.p., and up to 35-h.p., $10.000; 35 to 50-h.p., $20.00; more than 50-h.p., $25.00; electric vehicles, $5.00, with the exception of trucks.

Commercial cars, used solely as such, and motor trucks having a carrying capacity of two tons and less, $5.00 a car with a charge of $3.00 a ton for all over two tons.

Motor cycles are left at the same rate as last year, $3.00.

If registration for a car be applied for between October 1 and December 31 of any year, the license fee will be cut down to half the rate, as the Department recognizes that it is not fair to charge a man the full fee when he can only use his car during the remaining three months of the year.

Manufacturers and dealers can have licenses for five cars for demonstration purposes at $25.00 and, for each additional set, a charge of $5 will be made. Five licenses for motor cycle dealers will cost $10.00.

Determining Horse Power.

The new regulations provide that the Provincial Secretary may make special determination of the horse power of any motor vehicle for which registration is sought, but in general, and until otherwise determined, the horse power of gasoline automobiles will be fixed according to the formula adopted by the Association of Licensed Automobile Manufacturers, which is as follows:—Horse power equals bore squared, multiplied by number of cylinders divided by 2.5.

Despite the request of the motorists that the revenue from motor cars be "earmarked" and applied to good roads purposes, the new regulations make no provision for this.

GRAND FALLS, NFLD. REPORT.

THE report of the directors of the Anglo-Newfoundland Development Co., recently issued contains the financial statements for the year ending August 31, 1914. After making allowance for depreciation, the profits of the year are reckoned at £71,166 1s. 8d., as compared with £65,054 in 1913, and £51,233 in 1912. £10,000 of this is used to purchase debenture stock for cancellation, while other amounts are used to pay interest on debentures and for the sinking fund, leaving a balance of £36,288 7s. 6d. to be added to the credit balance of last year, and making a total of £81,476 14s. 2d.

The output of the mill during the past year has been very satisfactory, and the quality of the paper and pulp has not only been maintained but improved. Considerable sums have been spent in effecting improvements, and the company has acquired the remaining water and timber rights in the watershed of the Exploits Valley above Grand Falls, including an area of 250 square miles of very valuable pulp timber lands. The company gave $5,000 to the Sealing Disaster Fund, and is also making up loss in pay of their employees who joined the Newfoundland Contingent.

HYDRO-ELECTRIC RATES.

THE Ontario Hydro Commission have ordered a reduction in rates in every muncipality except Toronto. The reduction will save the light and power consumers $200,000 per annum in addition to the $150,000 per annum, saved by the 1913 reduction.

Successful has been the operation throughout the province of the people's Hydro-Electric enterprise. Notwithstanding that a year ago the Commission ordered a substantial reduction, the time was found to be ripe for a further cut. The principle of the Commission that low rates mean more business has been strikingly exemplified by the profits of the different municipalities in the power zone with their large capitalization of $11,000,000.

Under the policy of municipal ownership, all profits go back into the pockets of the consumer except in Toronto. Elsewhere the people are reaping the advantages of that policy, the reduction, it is estimated, meaning a saving to consumers of from 12 to 15 per cent. Port Arthur will get the highest cut with a reduction of 25 per cent. That city, London and St. Thomas will have the lowest rate for domestic and commercial lighting in the province.

Other reductions are:—Georgetown and New Hamburg, 20 per cent., Tillsonburg 18, Dundas, Galt, Guelph, Midland and Mimico 17 per cent., Milton, Rockwood and Thamesford 15 per cent., and Baden, Collingwood, Elmira, Hespeler, Ingersoll, Port Credit, Preston, St. Mary's, Stratford and Waterdown, 15 per cent. Fifty-five municipalities get reductions of over 10 and under 20 per cent., while fourteen get a 10 per cent. reduction.

A Great Advance.

The total hydro power consumption is 79,000, of which Toronto's share where there are 32,000 consumers, is 27,000 horse power. Forty municipalities were operating when the reduction was made last year. Seventy-two had plants three months ago, and there will be 90 before the end of the year.

The principal reduction is in the charge for floor space, which goes down from 4c. to 3c. per 100 feet, with a minimum of 1,000 and a maximum of 3,000 square feet. Another feature of the new schedule is the addition of a second rate for domestic consumers to encourage the general use of cooking, laundry and other appliances which will stimulate Hydro consumption. This rate will be 50 per cent. of the initial rate.

"We hope by this to encourage greater use of electrical power in the homes of the people, for toasters, stoves, irons, vacuum cleaners, and such appliances," explained Sir Adam. "Of course, it also means that the man who likes to have his house lighted more than usual gets the benefit of a lower rate on excess lighting."

Still another change is in the rates for current not used for lighting purposes. This will mean a reduction of 50 per cent. for small house owners on current in excess of 40 kilowatts, and for large householders whose consumption is over 100 kilowatts.

Basis of Rates.

Following is the basis of the new charges: — For incorporated villages, police villages and rural municipalities, 3 cents per 100 square feet of floor area per month, with minimum floor area charge for 1,200 square feet, and maximum floor area charge for 3,000 square feet. For urban districts outside the municipalities, 3 cents per 100 square feet of floor area with minimum floor area charge per month for 1,500 square feet and maximum floor area charge per month for 3,000 square feet. For cities and towns, 3 cents per 100 square feet of floor area per month, with minimum floor area charge for 1,000 square feet and maximum floor area charge for 3,000 square feet.a

Commercial Rates.

The new commercial rates, with a prompt payment discount of ten per cent. in each case, are:

	First 30 hrs.	Next 70 hrs.	Over 100 hrs.
Acton	10	5	1.0
Ancaster	10	5	1.0
Baden	8	4	0.8
Barrie	9	4.5	0.9
Beachville	9	4.5	0.9
Beaverton	8	4	0.8
Berlin	5	2½	0.5
Brampton	5	2½	0.5
Brantford	6	3	0.15
Caledonia	8	4	0.8
Cannington	8	4	0.8
Chesterville	10	5	1.0
Clinton	10	5	1.0
Coldwater	8	4	0.8
Collingwood	8	4	0.8
Creemore	14	7	1.4
Dundas	5	2.5	0.15
Elmira	9	4.5	0.9
Elmvale	9	4.5	0.9
Elora	9	4.5	0.9
Fergus	9	4.5	0.9
Galt	5	2.5	0.5
Georgetown	8	4	0.8
Goderich	9	4.5	0.9
Guelph	5	2¼	0.6
Hagersville	9	4.5	0.9
Hamilton	5	2¼	0.2
Hespeler	8	4	0.8
Ingersoll	7	3.5	0.7
London	5	2	0.5
Midland	5	2¼	0.5
Milton	7	3½	0.7
Mimico	7	3½	0.7
Mitchell	8	4	0.8
New Hamburg	7	3½	0.7
New Toronto	8	4	0.8
Norwich	7	3½	0.7
Ottawa	5	2	0.5
Paris	7	3½	0.7
Penetang	6	3	0.6
Peterboro	5	2.5	0.5
Petersburg and St. Agatha	12	6	1.2
Port Arthur	5	2	0.5
Port Credit	7	3½	0.7
Port Dalhousie	6	3	0.6
Port Robinson	6	3	0.6
Port Stanley	9	4½	0.9
Prescott	8	4	0.8
Preston	6	3	0.6
Rockwood	9	4.5	0.9
Seaforth	8	4	0.8
Sebringville	10	5	1.0
St. Catharines	5	2¼	0.6
St. Mary's	9	4.5	0.9
St. Thomas	5	2	0.5
Stayner	9	4.5	0.9
Stratford	6	3	0.6
Sunderland	12	6	1.2
Thamesford	10	5	1.0
Thorndale	12	6	1.2
Tillsonburg	7	3.5	0.7
Walkerville	8	4	0.8
Waterdown	9	4.5	0.9
Waterloo	6	3	0.6
Welland	5	2¼	0.5
West Hamilton	8	4	0.8
Weston	6	3	0.6
Windsor	8	4	0.8
Winchester	8	4	0.8
Woodbridge	9	4.5	0.9
Woodstock	5	2.5	0.5
Woodville	12	6	1.2

EUROPEAN ORDERS FOR UNITED STATES.

THE nations of Europe have placed contracts in the United States for more than $300,000,000 worth of supplies since the beginning of the war, according to Charles M. Schwab, president of the Bethlehem Steel Corporation, who arrived in New York from Britain on December 24. Mr. Schwab predicted that for this reason the United States was now at the threshold of the "greatest period of prosperity it has seen in many years."

Mr. Schwab, who sailed for Britain less than a month ago, admitted that the object of his trip was to cancel provisional contracts he had made with the British Government for the building of submarines. This he had done, he said, after having been advised by the Secretary of State Bryan that for an American concern to supply submarines to any of the belligerent nations would be a violation both in the letter and spirit of the neutrality of the United States.

The contracts given up, he said, were worth more than $15,000,000, but he had been able to secure while abroad contracts for the supply of various other munitions of war, although he declined to say with what nation they had been negotiated.

"The next big problem that the United States will have to face," said Mr. Schwab, "will be the development of transportation facilities in order to handle the tremendous increase in manufacturing and commercial enterprises.

GRAND TRUNK PACIFIC RAILWAY IN 1914.

DURING the year 1914, the work of grading on the Grand Trunk Pacific Railroad was practically confined to the main line, and even this was completed by the spring of the year. Track-laying was continued on the main line and several of the branches. In all about 190 miles of track were laid during the year, exclusive of second track, sidings, ballast pits, etc. A short re-survey of a portion of the Wattsview Boundary Branch was also made.

Main Line.

The entire grade was completed the early part of the year, and track was laid westerly from mile 1265 to mile 1374. On April 7, this made connection with the track laid easterly from mile 324 east of Prince Rupert to mile 372. The entire line was also ballasted, and is in operation throughout. The grading for Prince Rupert terminals has been practically completed, and the construction of roundhouse and divisional point facilities are presently under way at Prince George, Endako, Smithers and Pacific. The divisional point at McBride has also been installed with very modern equipment. This completes the terminals on the line with the exception of Prince Rupert, for which immediate plans are under construction. Fuel oil facilities in lieu of coal are being prepared for at the divisional points in British Columbia. The following steel bridges were also completed during the year:

Bridges.

Little Shuswap Crossing, mile 1101, consisting of one span.

3rd Crossing Fraser River, mile 1231, 950 feet.

Willow River, Mile 1262—450 feet.

4th Crossing Fraser River at Prince George (combination railway and highway bridge)—2650 feet.

Mud River, mile 1292—160 feet.

Upper Nechaco Crossing, mile 1373—675 feet.

Endako River Crossing, mile 1386, consisting of one span.

Endako River Crossing, mile 1403, consisting of one span.

Bulkley River Crossing, mile 1481, consisting of one span.

Bulkley River Crossing, mile 1486—350 feet.

Twelve bridges, each consisting of one span over fast mountain streams running into the Skeena River east of Prince Rupert, were also completed.

Branch Lines

Harte-Brandon Branch — Length 25 miles. No work done on this branch during the year. The grading is completed to mile 21.85. The substructure for the steel bridge consisting of two spans (450 ft.) was completed, but steel not yet erected, although on the ground.

Talmage-Weyburn Branch—Length 15 miles. Track was laid on this branch during the year and the branch put in operation.

Prince Albert Branch—Length 111.5 miles. Grade is completed throughout this branch and the tracklaying to mile 87.2, this being at the southern approach to the bridge over the South Saskatchewan River. This bridge will be 1200 ft. long and will consist of 6 spans. The substructure has just recently been completed ready for erection of steel. The branch is in operation to mile 87.2

Cut Knife Branch—Length 50 miles. Tracklaying was completed on this branch from mile 33 during the year. The line is in operation from mile 0 to 33.

Moose Jaw Northwest Branch—Length 67.68 miles. This branch is completed for 67 miles north-west of the city of Moose Jaw and is in operation. A steel under-crossing with the Canadian Pacific Railway at the western boundary of that city was built during the year.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Cobourg, Ont.—The by-law for a proposed bolt and nut factory carried by a large majority on Jan. 4.

Welland, Ont.—M. Beatty & Sons have received an order for a considerable quantity of shells for the British War Office.

Kingston, Ont.—The Kingston Locomotive Works has received orders to manufacture more shrapnel shells for the British War Office.

Peterborough, Ont.—It is proposed to spend $20,000 on an auxiliary steam pumping plant. Wm. Kennedy, Jr., of Montreal, is the engineer.

Montreal, Que.—The C. N. & Q. have obtained a permit to erect an engine house and machine shop, one storey, 120 x 80 ft., at an estimated cost of $4,500.

Montreal, Que.—The General Canning Co. contemplate erecting a new plant at an estimated cost of $3,000. Canning machinery and power plant equipment will be required.

Rocky Mountain, Alta.—J. J. Lundy is negotiating for the installation of an electric lighting system for the village. Mr. Lundy will meet the new council early in the year to submit his proposition.

Toronto, Ont.—Fifteen armoured motor cars are being constructed by the Russell Motor Car Co. The total cost of these cars with equipment will be $100,000, which is being donated by J. C. Eaton of this city.

Beaverton, Ont.—A by-law to authorize a loan of $6,000 to George Minorgin & Son of the Beaverton Foundry was carried here last Monday by almost unanimous vote. In addition to their present business, Minorgin & Son will manufacture an extensive line of toys and other goods.

Municipal

Milton, Ont—The shoe factory by-law carried.

Newmarket, Ont.—The by-law to raise $$15,000 for a hydro-electric system was defeated here on Jan. 4.

Salmon Arm, B.C.—A by-law will be voted on to raise $2,500 for the purchase of fire-fighting equipment.

Berlin, Ont.—The by-law to purchase an incinerator at a cost of $14,000 was carried by a majority of 156.

Welland, Ont.—A by-law to authorize the expenditure of $5,000 on a fire alarm system was carried last Monday.

Arnprior, Ont.—The by-law passed to exempt Arnprior Felt Co. from certain taxes and free water for five years.

Chatham, Ont.—The electors passed a by-law to grant financial assistance to the Everlasting Casket and Vault Co., a new concern.

Brantford, Ont.—Ratepayers endorsed a by-law calling for the expenditure of $100,000 to complete the local waterworks system.

Aurora, Ont.—The by-law authorizing the raising of $8,000 by debentures for the waterworks system was passed by a vote of 341-42.

Sarnia, Ont.—The ratepayers last Monday defeated by a vote of 927 to 157 a by-law calling for the expenditure of $60,000 on a city hall.

Weston, Ont.—The by-law to raise $6,000 by debentures to purchase the site for the waterworks was carried by a big majority here on Jan. 4.

St. Catharines, Ont.—Fire Chief Early in his annual report to the council recommends the purchase of an automobile combination chemical and hose truck.

Toronto, Ont.—By-laws were passed on January 1 to authorize the purchase of the Scarboro Division of the York Radial Co., and also for extensions to civic car lines.

Brampton, Ont.—The by-law to exempt the Williams shoe factory extension from taxes other than school and local improvements failed to get sufficient votes to pass it.

Regina, Sask.—The city waterworks department are preparing plans for extensions to the water supply system. R. O. Wynn-Roberts, consulting engineer, has the work in hand.

Essex, Ont.—Two by-laws were carried on Monday, one to grant concessions to the Essex Canning and Preserving Co., and the other to authorize the expenditure of $6,500 on waterworks improvements.

Kingston, Ont.—Two by-laws, one to permit J. M. Campbell to erect poles and wires on the streets, and the other to construct a railway siding on Ontario street for the benefit of a number of industries, were carried.

Bracebridge, Ont.—By-law to guarantee a bond for $20,000 in connection with the establishment of a linen industry was carried, also a by-law to raise debentures for the development of High Falls for electric power purposes.

Ottawa, Ont.—The Provincial Board of Health have decided to investigate the Curry-McVeity Ottawa river filtration plans. The Board have already refused to approve of the plans on the ground that the source of supply is not satisfactory.

St. Catharines, Ont.—Ratepayers of the village of Port Dalhousie last Monday carried a by-law to provide $50,000 by the issue of debentures for the introduction of a waterworks system, on a vote of 133 to 36. It is proposed that a supply of water be obtained from the St. Catharines system, and piped by a main to the new village system to be installed.

Toronto, Ont.—At Osgoode Hall on Dec. 24. Mr. Justice Middleton gave judgment for $14,760.21 in favor of Loomis, McBean and Williams against the City of Ottawa in connection with the intake pipe contract. He dismissed the city's claim for $25,000 damages and a penalty of $9,200. Judge Middleton held that the action of the city in discharging Engineer Currie and his refusal to certify dispensed with the necessity of any certificate from him as a condition precedent of the right of action.

Electrical

Berlin, Ont.—The Kauffman Rubber Co. are in the market for electrical equipment.

Berlin, Ont.—The new scale of rates decided upon by the Hydro Commission was adopted by the Light Commission here on Dec. 30. The commercial rates were slightly reduced, but the power and street lighting rates remain the same as

in 1914. The net profit of the electric department for the year will be approximately $13,000.

Toronto, Ont.—The Toronto Hydro-Electric Commission has decided to comply with the order to reduce the rate, made by the Provincial body, in all but two requirements. These two rates to which the local Commission objects are for power, first alternating current, and second, direct current. It is declared that these rates affect principally the waterworks system. A conference between the two bodies is being sought.

Toronto, Ont.—The Hydro-Electric power by-laws, which were voted upon in eleven towns throughout the province, chiefly in the north-western district, on the new Eugenia Falls system, were, with one exception, successful. Newmarket defeated the Hydro policy by a majority of 109 votes. The following Hydro by-laws were carried:—Eugenia Falls system—Durham, Shelburne, Dundalk, Delaware, Mount Forest, Chatsworth, Huntsville. Niagara system—Lambeth, Bothwell.

London, Ont.—The Ontario Hydro-Electric Commission is placing a survey party in the field shortly, under Engineer Bucks, to collect information on tentative radial railway routes in the district north of London, Sarnia, Chatham and Stratford. A party under Mr. Stanley is now working on a survey between Guelph and Stratford. Chief Engineer F. A. Gaby states that for the purpose of preparing estimates, trial lines have been laid from Guelph northward through Fergus, Flesherton, Markdale to Owen Sound and Meaford; also from a junction point on this line just east of Arthur, through Arthur, Mount Forest, Hanover and Chesley to Owen Sound; also from Guelph through Milton and Port Credit to Toronto.

General Industrial

Lindsay, Ont.—Horne Bros. contemplate rebuilding their woolen mill which was recently destroyed by fire.

London, Ont.—The De Luxe Specialty Co. will shortly begin the manufacture of cleaning compounds. William Brock is manager.

Lethbridge, Alta.—It is reported that the Cream of Wheat Products Co., of Minneapolis, Minn., may establish a plant at Lethbridge.

Kincardine, Ont.—At a special meeting of the Council held on Dec. 29, it was decided to loan William Mitchell the sum of $1,500 for the purpose of assisting him in establishing a woollen mill.

Port Moody, B.C.—It is reported that another oil industry in the shape of a refinery will be established in Port Moody in the near future. The Shell Oil Co. is said to be negotiating for a site. The company is a Californian one, with extensive oil holdings and with a branch office in Vancouver.

Tenders

Outremont, Que.—The time stipulated for the reception of tenders for the construction of a school here, and which should have expired on Dec. 29, 1914, is extended until January 22. Copies of plans may be had at the office of J. A. Godin, architect, 269 St. Denis street, Montreal, where estimates may be seen.

Toronto, Ont.—Tenders will be received up to Tuesday, Feb. 2, 1915, for the supply and delivery to the Street Cleaning Department of 100 (more or less) loose paper can receptacles, as may be required. Specifications may be seen and form of tender obtained, together with all information relative thereto, at the office of the Street Cleaning Department, City Hall, Toronto.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, up to Tuesday, February 16th, 1915, for supply and installation of furnaces and appurtenances for refuse incinerating plant. Specifications and tender form for the foregoing may be obtained upon application at the office of the Street Commissioner, Department of Street Cleaning, City Hall, Toronto.

New Hamburg, Ont.—Tenders will be received up to Wednesday, Jan. 20, 1915, for the purchase of the real and personal property of the New Hamburg Manufacturing Co., Ltd. The plant is adapted for the manufacture of threshing machines, engines, cement mixers, etc. Full detailed particulars may be had on application to Charles J. Fox, New Hamburg, and Bissett & Peine, 24 Adelaide Street East, Toronto.

Railways-Bridges

Montreal, Que.—It is proposed to build a tunnel under the Lachine Canal on Wellington street. The cost is estimated at $750,000 and $1,500 has been appropriated by the Board of Control for work on plans.

Ottawa, Ont.—According to Sir Donald Mann, the C. N. R. will not ask for further legislation this session. The only request, he states, will be for extension of time to build branch lines, work on which has had to be suspended owing to the war.

St. John, N.B.—A conference between Premier Clarke and F. P. Gutelius, general manager of the I. C. Railway on Dec. 22, arrangements were completed to open the St. John Valley Railway as a part of the Intercolonial System from the commencement of the new year. The construction company is operating the line at present.

Pacific Great Eastern.—D'Arcy Tate, vice-president of the Pacific Great Eastern Railway, reports that grading is rapidly being completed on the different sections of the Pacific Great Eastern Railway, between the end of the track, at the head of Anderson Lake, and Fort George. It is expected that rails will be laid to Lillooet, thirty-two miles beyond Anderson Lake, early in February. The track now extends eighty-seven miles from Squamish. Train service will probably be extended from Pemberton, the present terminus, fifty-seven miles from Squamish, to Anderson Lakes, by Jan. 1915. New schedules are now being prepared. It is planned to operate a daily service, except Sundays, each way with mixed trains.

C. N. R. Desires Time Extensions.—Notice has been given by the C. N. R. of applications to Parliament for time extensions for the construction of a large number of lines in Eastern and Western Canada. Among these are lines from Hawkesbury to a point in Leeds or Lanark, Washago to Kincardine, Arnprior to Gananoque, Pembroke to Cobourg or Port Hope, Niagara River to Goderich, Berlin to St. Mary's and Woodstock and others in Ontario; Rawdon northerly to the N. T. R., with a branch to Joliette, and St. Jerome to St. Eustache in Quebec, and a large number in the West. The James Bay and Eastern Railway Co. and the Southern Central Pacific Railway Co. are also applying for time extensions.

C.N.R. Appeal for Aid.—Sir William Mackenzie and Vice-President D. B. Hanna, of the Canadian Northern, were in Ottawa on Dec. 29, and are understood to be placing a statement of their affairs with respect to the recent bond guarantee before the Government. The Canadian Northern, so far as can be learned, has been unable to realize on its securities owing to the war and the consequent disturbance of all financial arrangements. In the action taken by Parliament at the last regular session, the war situation was not contemplated, and the measures then adopted which made ample provisions for all requirements under normal conditions have not produced cash results except to a figure far below the amount of the guarantee. The present proposal seems to be that the Government assist the company to realize on the securities which they have.

Personal

George H. Webster, a well-known civil engineer, formerly with the C. P. R., died in Vancouver, B. C., on Dec. 29.

Col. A. C. Labelle and Farquhar Robertson, Harbor Commissioners of Montreal, recently visited and inspected the harbor works at St. John, N.B.

John C. Newman, a director of Canada Steamship Lines and other important Montreal concerns, is again able to be at his office, after a severe illness.

John Hasson Miller died in Montreal on Dec. 29. Mr. Miller was born in Pittsburgh, Pa., in 1844, and came to Montreal in 1904 to join the staff of the Montreal Rolling Mills, from which company he retired a few years ago.

E. V. Buchanan, of the Public Utilities Commission, has been appointed to take full charge of its various departments which General Manager H. J. Glaubitz and Assistant Manager Hunt have been relieved of pending the judicial inquiry into the charges preferred against them.

C. D. Howe, Dominion Government engineer in charge of the work at the elevator, Saskatoon, Sask., will probably complete his work about the middle of January. Mr. Howe will go from there to Calgary or Vancouver, at both of which places elevators are to be built in the near future.

L. S. Humes, formerly local manager of the Great North-Western Telegraph Co. in Montreal, has been appointed district superintendent in connection with the taking over of the C. N. R. telegraph lines by the G. N.-W. Mr. Humes will have jurisdiction over all G. N.-W. offices in New Brunswick, Quebec and Ontario east of Kingston, with headquarters at Montreal.

Trade Gossip

The American Steam Pump Co., Battle Creek, Mich., have sent out a Christmas card to their friends. It is printed in two colors, and shows a view of the factory, under which is inscribed seasonable greetings.

The Taylor Engineering Co. of Vancouver, B.C., which was recently incorporated, will manufacture pumps and other power plant equipment. A. J. T. Taylor is the managing director, and the capitalization is $50,000.

Montreal, Que.—One of the biggest pieces of insurance business handled in Canada has fallen to the firm of Marsh and McLennan, inc., of London, New York and Montreal. This is the risk—about $15,000,000 — covering the Canadian Pacific steamships on both Atlantic and Pacific routes.

The Ideal Incinerator & Contracting Co., Toronto, have been awarded contract for civic incinerator for the City of Berlin, Ont. By-law was submitted to ratepayers on January 1, 1915, and passed. The company will begin work this month. Incinerator has capacity of 25 tons a day and, with extensions to be made, a capacity of 45 tons a day will be available.

Toronto Board of Trade.—The new quarters of the Board of Trade on the nineteenth and twentieth floors of the Royal Bank building were formally opened on Dec. 29 in the presence of a representative gathering of the members and their friends. The board, which was organized seventy years ago, has a membership of 2,500. Premier Hearst inaugurated the new quarters.

Montreal, Que.—The C. E. Deakin Co., one of the largest contracting firms in Canada, went into liquidation on Jan. 4, when a winding-up order was granted by Judge Charbonneau on the application of the Structural Steel Co. The Steel Company declared it was a creditor for $1,000, part of which was represented by a promissory note, which had been refused payment. E. A. Wright was appointed provisional liquidator.

Montreal, Que.—The White Star-Dominion Line has decided to merge the management of the Portland and Montreal offices, with John Torrance as manager and P. V. G. Mitchell as assistant manager, the appointments becoming effective January 1, 1915. The headquarters of the company will remain in Montreal. This reorganization is consequent on the death of Manager James Thom of Montreal, which occurred on November 26.

Newcastle, N.B.—Three-fourths of the New Brunswick pulp mill at Lower Derby, six miles from here, built six years ago, and doing a large business, was burned on January 1, leaving only the chemical and boiler plants. The damage, about $100,000, is well covered by insurance in some thirty companies. The mill, which generally employed 100 people, had been shut down since the middle of last May. The company will rebuild on the Miramichi, but whether at Millerton or Newcastle is uncertain.

Montreal, Que.—The Canadian railways are considering the raising of their freight rates on goods being exported to the United States by 5 per cent. This will correspond with the increase of 5 per cent. sanctioned by the Interstate Commerce Commission for all goods except coal and iron ore, exported from the United States into Canada. The latter increase will come into effect January 15, after ten days' notice has been given, but owing to the Dominion Railway Commission requiring 30 days' notice of any change, it is not anticipated that the Canadian roads will increase their charges until the middle of February.

Catalogues

Second-hand Machinery.—We have received from Thos. Mitchell & Sons, Ltd., Bolton, Lancashire, England, a copy of stock catalogue No. 46, which contains a long list of new and second-hand engines, boilers, pumps, machine tools and contractors' plants, etc.

The Hamilton Facing Mill Co., Ltd., Hamilton, Ont., are distributing among their friends an attractive calendar for 1915. It consists of a reproduction of the painting, "Scotland by the Sea," on a stiff white frame, mounted on a green background, the calendar being situated below the picture. Altogether it is quite an artistic production.

Graphite Paint.—The United States Graphite Co., Saginaw, Mich., has issued a booklet dealing with the properties and application of Mexican graphite paint. The booklet contains some useful information on graphite and graphite paint, with a number of comparative analyses of various brands. A feature of the booklet is the large number of excellent illustrations reproduced from photographs taken of buildings, bridges and other steel structures where the paint has been used. This is a handsome catalogue, having several artistic features, and being generally well gotten up.

Hoists.—The Wright Mfg. Co., Lisbon, Ohio, has issued catalogue No. 6, descriptive of the Wright standard chain hoists, one type being a triplex or spur geared, and the other a screw hoist. The construction of each type is described in detail, while a series of tables give the price of each size and the prices of the various parts. The illustrations show the various types of hoist and the parts used in their construction, the latter being numbered to correspond with the tables for convenience when ordering spare parts. Other products described include the "Wright" differential chain block, steel trolleys and hand travelling cranes.

Steel Sash.—An exceedingly attractive catalogue No. 8 has been issued by David Lupton's Sons Co., Philadelphia, Pa. The catalogue deals principally with the "Lupton" steel sash for factories, power houses, etc. A full description is given covering the construction of the

The "Cadillac" 1915, Eight Cylinder Automobile Motor

Staff Article

Automobile manufacturers perhaps more than those in any other sphere of industrial enterprise have striven to completely standardize their product, and have in consequence had installed in their plants much automatic and otherwise special machinery equipment. A radical change such as the introduction of an eight cylinder motor generally means the scrapping of many machine tools, therefore, this Cadillac development arouses special interest.

CERTAIN practices and principles have become standard in the manufacture of the automobile motor. Among the principles almost universally considered as standard is the four-stroke cycle design. This type engine is also always built single acting, thus there is only one power impulse per cylinder in every four strokes or two revolutions. The problem to be solved has been the construction of an engine that will be perfectly balanced, and to produce such an engine has been the aim of all motor designing engineers.

The old single-cylinder engine, known often as the "one lunger," was early superseded by the four-cylinder engine, and one could almost say that a four-cylinder unit then became standard design for automobile motors because, for several years following, every American factory, with possibly a few exceptions, adopted it. However, the demand for a more perfectly balanced engine, one whose operation was more smooth, and one that would develop more power at slower speeds, soon became manifest. Experiments were made with the long-stroke motor and the six-cylinder motor, with the result that the popularity of the combination long-stroke six-cylinder unit grew, a number of large motor firms starting its manufacture to the exclusion of all other types. The six-cylinder motors had, threefore, apparently come to stay, when the startling announcement of the Cadillac Motor Car Co. was published. This stated that their 1915 model car would include an eight-cylinder motor.

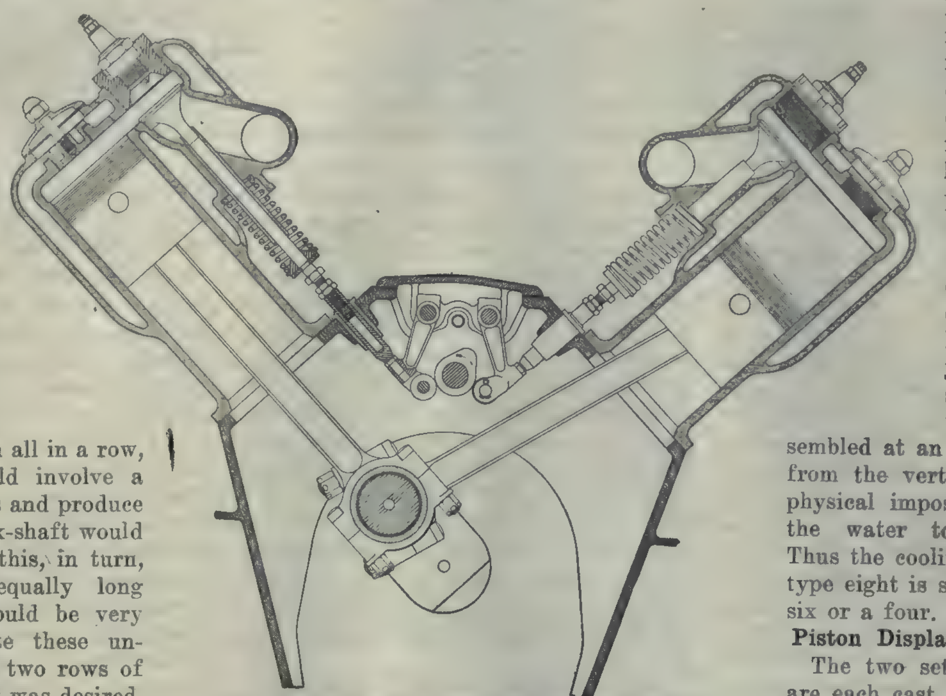
The new Cadillac "eight" has been developed from the French design introduced some years ago by the DeDion Bouton Co. in France. The eight cylinders are arranged in two groups of four each, and these groups are mounted at 90 degrees to each other on the crank-case. The first inquiry one would be likely to make is why "eight" cylinders, and will the addition of two more cylinders make a justifiable difference in performance, as compared with a six-cylinder motor? In an "eight" there are, of course, eight power impulses during each complete cycle of two crank-shaft revolutions; that is to say, there is a power impulse every quarter turn of the crank-shaft, thus there is a complete overlapping of power strokes and the resultant effect is a turning effort that is practically constant. In a "six," a power impulse occurs every one-third revolution of the crank-shaft, and though there is always a turning effort upon the crank-shaft, it fluctuates more due to the longer interval between im-

THE NEW CADILLAC EIGHT-CYLINDER CAR.

pulses. In a four-cylinder motor there are obviously periods when no turning moment is exerted on the crank-shaft, thus the flywheel is called upon to carry the engine over these power lapses. Due to its continuous turning effort, the six-cylinder had become universally popular, yet this continuous turning effort is even more pronounced still in the "eight."

Cylinder Arrangement.

The simplest arrangement of the eight cylinders would be to have them all in a row, but this design would involve a great many difficulties and produce an engine whose crank-shaft would be abnormally long; this, in turn, would require an equally long crank case which would be very heavy. To eliminate these undesirable factors, the two rows of cylinders arrangement was desired. If the eight cylinders were in a single row it would require two series of crank-shaft throws, on the quarter, but, by placing the two rows of cylinders at an angle of 90 degrees such a requirement is dispensed with and the same effect accomplished. Thus, the type of motor is known as the V type.



END ELEVATION OF ENGINE SHOWING ARRANGEMENT OF CYLINDERS, OPERATION OF CAMS, WATER JACKETS AND GENERAL DESIGN OF MOTOR. THE VALVES SHOWN ARE INTAKE VALVES. NOTE "TULIP" DESIGN OF VALVES TO FACILITATE ENTRY OF GAS INTO CYLINDERS.

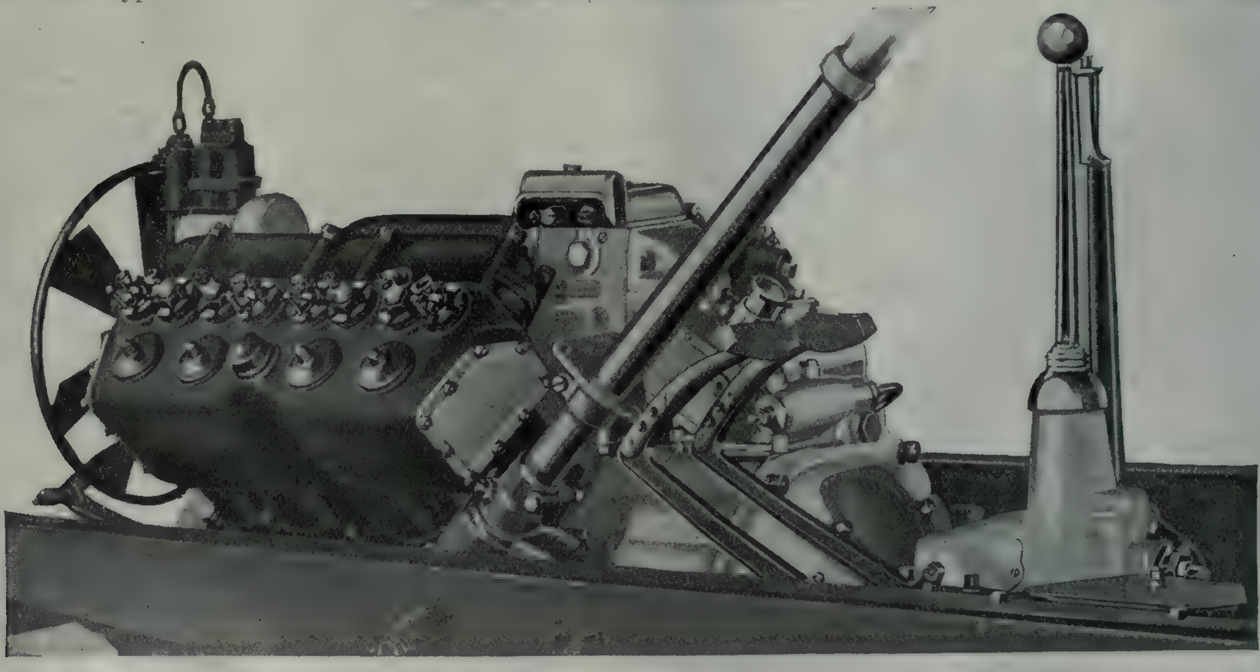
Arranged in this way, the eight-cylinder motor is no longer than the four-cylinder motor of equal bore, and as compared with a "six," it has about one-third less length. This results in a shorter crank-case, which is a weight reducing factor. In addition, the crank-shaft is of the same form as that used in a four, the throws being all in one plane, whereas the throws of a six are in three planes. This results in a simpler process of manufacturing. The shorter shaft is also less given to periodic vibration, and the cam shaft is shorter and less given to whipping. In view of the foregoing, when comparing the new "eight" with the "six" as far as weight is concerned, the "eight" has a decided advantage. Again, the Cadillac "eight" has proved itself to be sixty pounds lighter than the four-cylinder engine formerly used. The difference is mainly due to the fact that it is shorter and has lighter reciprocating parts.

Cooling.

Each separate set of cylinders may be cooled separately. Further, the water jackets are so designed that when the cylinders are assembled at an angle of 45 degrees from the vertical, it is almost a physical impossibility for any of the water to get into pockets. Thus the cooling system of the V-type eight is superior to that of a six or a four.

Piston Displacement and Power.

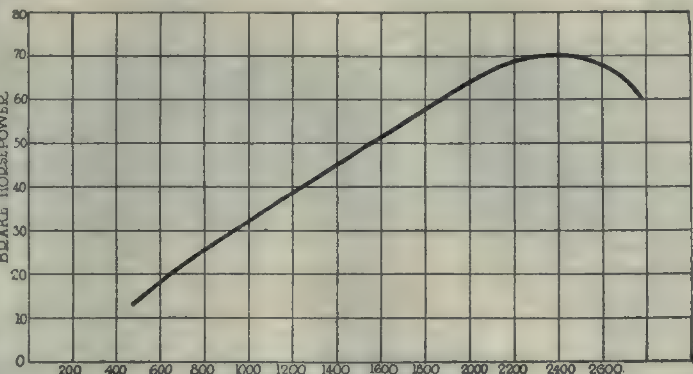
The two sets of four cylinders are each cast "en bloc" and present much the same appearance as any other block of four. The bore is $3\frac{1}{8}$ inches and the stroke $5\frac{1}{8}$ inches, giving a total piston displacement of 314 cubic inches. The S. A. E. formula rates this motor at 31.25 horse-power, although this formula is not really applicable, for on dynamometer tests it has developed 70 horse-power at 2400 revolutions per minute.



EIGHT-CYLINDER CADILLAC ENGINE AND POWER PLANT PLACED IN CHASSIS. MULTIPLE DISC CLUTCH IS PLACED IMMEDIATELY TO REAR OF MOTOR, AND THE TRANSMISSION GEARS ARE PLACED IMMEDIATELY TO REAR OF CLUTCH. GEAR SHIFT LEVER IS SHOWN WITH THE BALL HANDLE.

The blocks of cylinders are bolted to the copper alloy aluminum crank-case which

is common to both, and which is split horizontally into two sections, the lower portion being the oil pan. The upper half carries the crank-shaft which has three main bearings. Both sets of connecting rods connect to this crank-shaft, one throw-bearing taking care of a pair of rod-ends, in opposite cylinders. In order for both to fasten on the same bushing, one rod has a yoked end, the other rod fitting within the yoke arms. Two caps are thus required for the yoke, one for each arm of the yoke. These fit around the outer part of the bushing, gripping it rigidly, due to the cap bolts. In addition, pins go through the rod into the bushing so as to insure the two moving together. The other rod fits around the bushing within the yoke, and is free to turn on the bushing. Thus, in operation, the bearing for the yoke and rod is the inner surface of the bushing against the shaft, while that of the other rod is the outer surface of the bushing. These bearings have babbitt linings in reinforced phosphor-bronze shells. There are, therefore, four connecting-rod bearings on the crank-shaft just as with a four-cylinder motor. The total length of the crank-shaft to the outer ends of the end bearings is 26 1/16 inches.



CURVE SHOWING BRAKE HORSE POWER AT ALL REVOLUTIONS FROM 400 TO 2600.

Directly above the crank-shaft is the single camshaft with but eight cams, one cam operating two opposite inlet valves, or two opposite exhaust valves, as the case may be. The cam assembly is on the under side of a plate which bolts to the top of the crank-case between the two blocks of cylinders. Pivoted to this plate also are the small arms which are interposed between the ends of the push-rods and the cams, so that the lift will be straight upward instead of being a side thrust component. The cam-shaft is supported by five bearings, while a small air-pump maintaining a pressure for fuel feed is driven by an eccentric located on forward end of cam-shaft.

Vertically in line above the cam-shaft and crank-shaft is the generator shaft which drives the fan and the combined motor-generator mounted on top of the cam-shaft plate, and lying between the cylinder blocks. This generator shaft also carries a gear which may be meshed with that of the tire pump carried at the forward end of the motor. Both the cam-shaft and the generator shaft are driven by silent chains which are completely housed at the front end of the motor. The cam-shaft carries two sprockets, the outer carrying the chain running down to the crank-shaft sprocket and the inner driving the chain which passes around the generator shaft sprocket above. The water and oil pump drives are interesting.

At the front of the engine, and below the crank-shaft, is a transverse shaft driven from the crank-shaft by spiral gears. There is also here a centrifugal water pump for each of the two sets of cylinders, one being located on either end of the transverse shaft. Below the spiral gear on the water pump shaft is located a third spiral gear, whose shaft is parallel to the crank-shaft. A small gear oil pump is located on the forward end of this shaft for crank shaft bearings and connecting rod supply.

In order to secure the accurate balance necessary to a high-speed motor of this type so that it will be practically free from vibration, the pistons and connecting rods are machined to very close limits. Uniformity of weight is also important. Remarkable lightness of these parts has been attained due to the use of a special alloy steel for the rods which possesses great strength with extreme lightness, and also to the special form of the cast-iron pistons, each of which has three ring grooves, with three thin steel rings per groove. The wrist pins are fixed in the connecting rods and oscillate in the pistons. They are constructed of chrome nickel steel, case-hardened and are ⅝ of an inch in diameter.

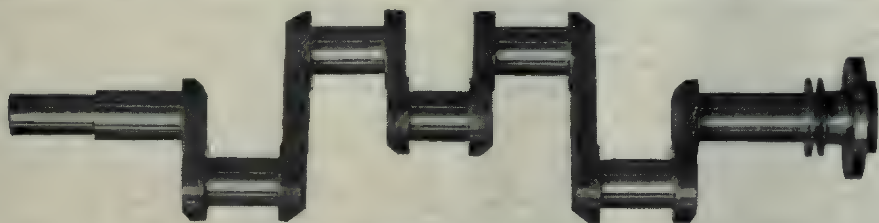

ENGINE MOUNTED IN CHASSIS. VIEW FROM THE REAR.


FRONT VIEW OF ASSEMBLY OF ENGINE

As another indication of the refinement to which this motor has been subjected, the intake valves are of the tulip shape design so as to facilitate the inlet of the gas, while the exhaust valves are of the flat type and are of tungsten steel.

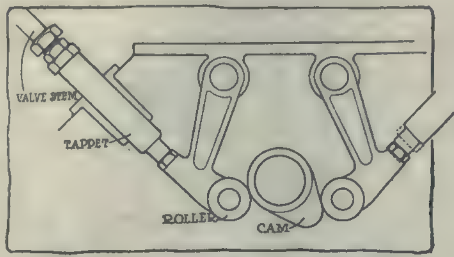
Order of Firing.

In firing, the order alternates from one side to the other, so that there is a power impulse first from a cylinder on one side followed by an impulse from a cylinder on the opposite side. The order of firing in each set of cylinders is as follows: One, three, four, two, it being always understood that the forward cylinder is cylinder number one and the rear cylinder is cylinder number four. It is now apparent that there will be the same definite interval between the firing of all cylinders of the same numbers on opposite rows.



EIGHT-CYLINDER CRANK SHAFT.

The direction of rotation of the crankshaft and the cam shaft is the same, and is such that the right-hand cylinders fire before those of the left-hand of the same numbers. The interval between these two cylinders is that which the cam-shaft requires to make one-quarter of a revolution, because the cylinders are set at 90 degrees, and this one-quarter revolution of the cam-shaft represents a one-half revolution of the crank-shaft. With this explanation, the order of firing will be as follows, the crank-shaft making two revolutions to obtain an impulse from each of the eight cylinders; thus an impulse occurs for every quarter turn of the crank-shaft:



CAM MOVEMENT APPLICATION TO VALVE STEM.

One right—four left.
Three right—two left.
Four right—one left.
Two right—three left.

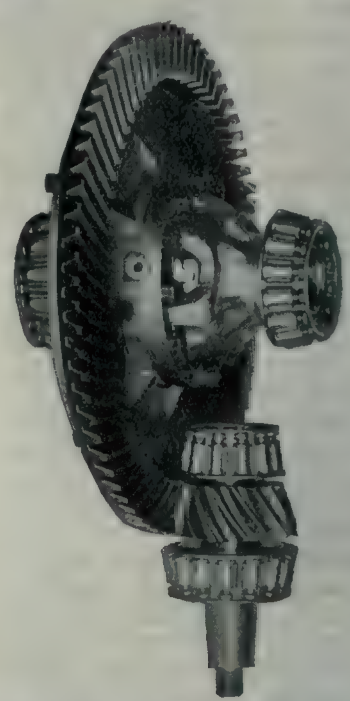
The accompanying diagram will perhaps more clearly express the matter:

		Front		
	(6)		(1)	
Left	(4)		(7)	Right
	(8)		(3)	
	(2)		(5)	
		Rear.		

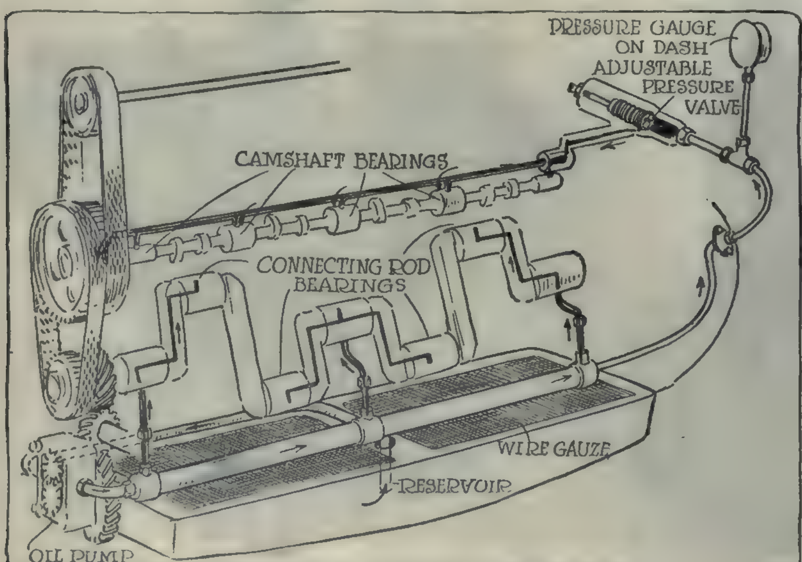
The valves are timed as follows: All inlet valves start to open on top dead centre and close 45 degrees beyond bottom dead centre. The exhaust valves open at 45 degrees before bottom dead centre and close at top dead centre.

Carburetor.

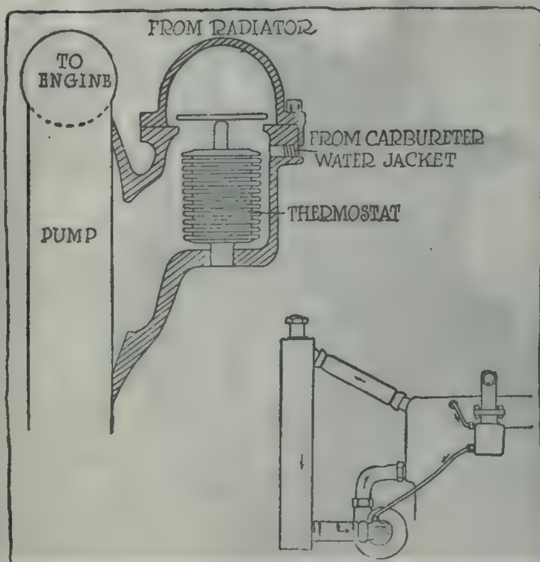
The Cadillac single-jet carburetor, specially designed for this type of motor, is used. It occupies a position midway in the engine between the two rows of cylinders and a form of U manifold leads from it to the intake manifold of each of the two blocks of cylinders. The distribution to the various cylinders is done within the castings and pressure feed supplies gasoline to the fuel chamber of the carburetor.



SPIRAL BEVEL DRIVE GEAR AND DRIVE PINION WITH TIMKIN ROLLER BEARINGS, ALSO DIFFERENTIAL GEAR SET IN SPHERICAL HOUSING IN HUB OF DRIVE GEAR.



DIAGRAMATIC VIEW OF OILING SYSTEM. OIL IS STRAINED THROUGH METAL NETTING AND GRAVITY FED TO PUMP.

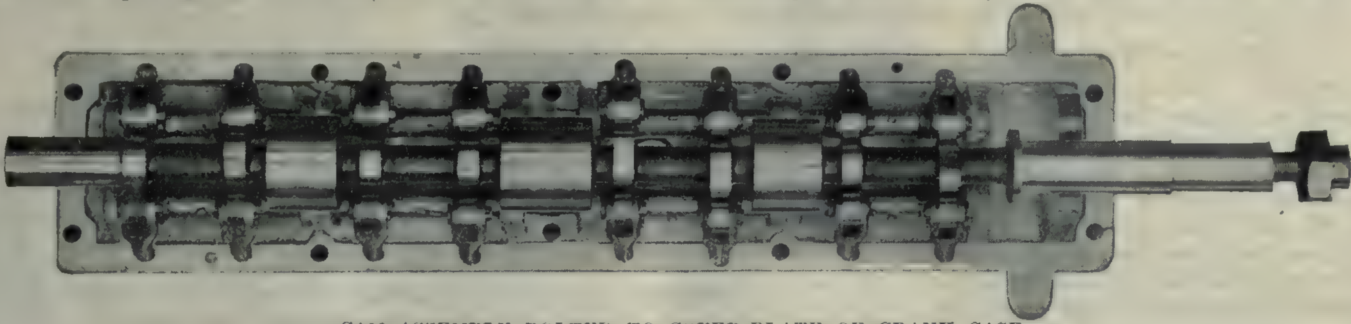


DIAGRAMATIC VIEW OF THERMOSTAT AND THE VARIOUS PASSAGES FOR WATER CIRCULATION.

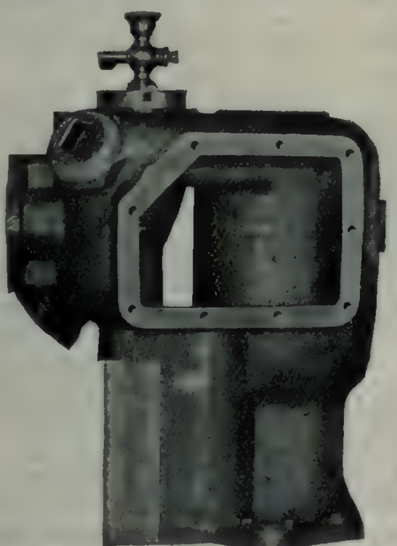
Water Circulation Control.

An entirely new feature in automobiles is the application of thermostatic

control to the temperature of the cooling water, so that in running, this water is maintained at nearly a constant temperature. In principle this thermostatic regulation is the same as that used in connection with the heating systems of houses.

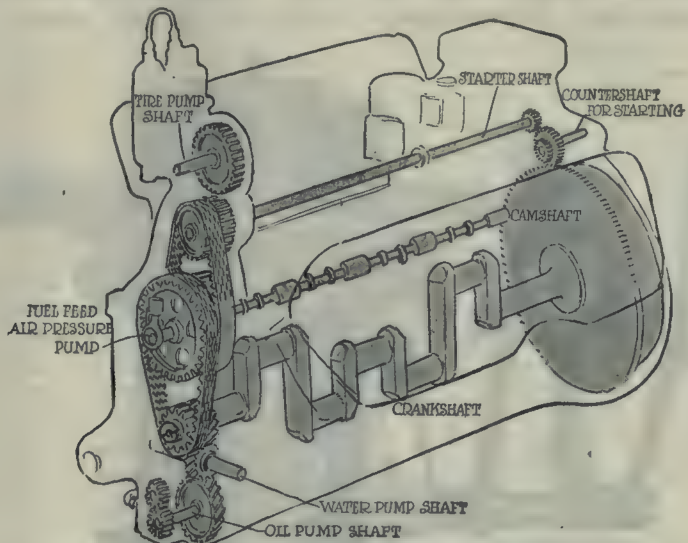


CAM ASSEMBLY BOLTED TO COVER-PLATE OF CRANK CASE.



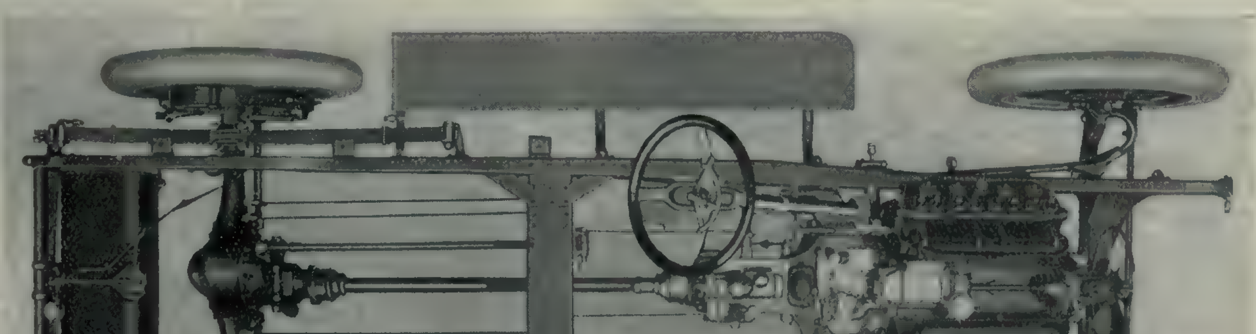
BLOCK CASTING OF FOUR CYLINDERS. NOTE LARGE WATER JACKET AND ALSO THE FACT THAT COMPLETE ACCESS TO SAME IS OBTAINED THROUGH THE LARGE HAND-HOLD COVERS.

In the Cadillac application, there is interposed in the water pump line for each set of cylinders a thermostat which is simply a small coiled copper tube containing a liquid which expands or contracts in accordance with the temperature, thus slightly lengthening or contracting, its total movement being ¼ in. This thermostat is in connection with a valve so that when it expands, it raises the valve from its seat, the valve controlling the flow of water to the radiator from the pump. A by-pass connects with the water-jacket of the carburetor.



DIAGRAMATIC VIEW OF ENGINE SHOWING ARRANGEMENT AND DRIVES OF THE VARIOUS ACCESSORIES OF THE ENGINE.

When the engine is started, the water is naturally cold, therefore the thermostat is contracted and its valve is on its seat. Thus, the radiator water is shut off, the circulation being simply through the water-jackets of the cylinders, through the by-pass to the carburetor jacket, and thence back to the cylinders. There is, therefore, only a small quantity of the water circulating, and when this heats up, the thermostat begins to



CHASSIS ASSEMBLY OF THE EIGHT-CYLINDER MOTOR.

expand and lift its valve from the seat, thus allowing the radiator supply to flow into the system, The action is so regulated that the temperature of the water is nearly constant.

Motor Lubrication.

The motor lubrication system incorporates a positive force feed system. An oil gear pump, located at the forward end of the motor and driven from the crank-shaft, takes up the oil from the oil pan in the lower part of the crank-case, and forces it through a reservoir pipe running along the inside of the crank-case, from which pipe there are leads to each of the main bearings. The crank-shaft and webs are drilled and oil is forced from these main bearings to the connecting-rod bearings through the drilled holes. The forward and rear main bearings supply the rod bearings nearest them, while the central main bearing supplies the rod bearings on either side of it. The oil is then forced from the main reservoir pipe up to the relief valve which maintains a uniform pressure above certain speeds and overflows from this valve to a pipe extending parallel to the cam-shaft and above it. Leads from this pipe carry lubricant by gravity to the cam-shaft bearings and front-end chains. Pistons, cylinders and piston-pins get their oiling from the oil thrown by the lower ends of the connecting rods.

Electrical Accessories and Ignition.

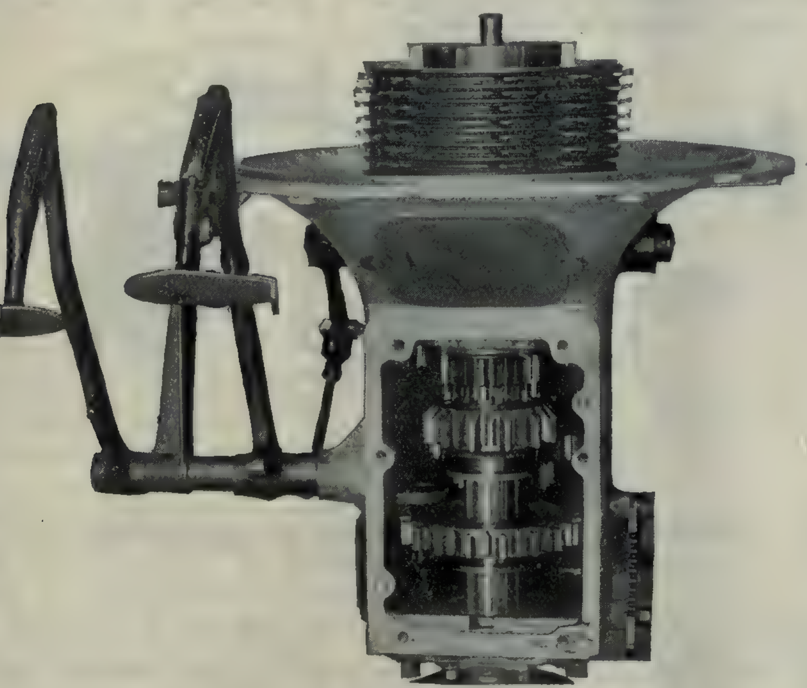
The Delco electrical system consisting of a combination unit for cranking, lighting and ignition is employed, while a feature of the unit is the special eight cylinder distribution. The motor-generator unit runs at the cam-shaft speed and is driven by a silent chain. At the rear of the generator is the train of gears which mesh with the teeth in the flywheel rim for cranking purposes, and these gears are not in mesh unless the starter pedal is depressed. The reduction between the electric motor-generator speed and the engine speed is 25 to 1. The Delco unit, while cranking the engine temporarily becomes an electric motor and turns over the engine. The current is received from a storage battery.

General.

When on the road the performance of this car is indeed a surprise, a speed of from two and a half to three miles per hour, to the maximum, being obtained when running on high gear. The long stroke and the very generous over-lapping of power impulses make the motor an ideal hill climber, it being practically impossible to stall the motor. Again, the motor accelerates the speed of the car very rapidly, and thus but little time is lost in crowded streets. For touring, the car negotiates heavy roads and hills with comparative ease.

The steering wheel is placed on the left and two separate exhaust pipes and mufflers are fitted to the car. With the old four-cylinder motor, a two-speed rear axle was fitted to the car, but the extreme flexibility of the new eight-cylinder motor redners this type of axle of no avail, so the simpler form of one-speed axle is used.

A real appreciation of this new engine cannot be realized until one has driven one of these new cars, and to drive such a car is to become immediately converted into an ardent supporter of the eight-cylinder motor, and what is perhaps of not the least importance, the price of the Cadillac 1915 eight-cylinder model is the same as that of the 1914 four-cylinder car.



MULTIPLE DISC CLUTCH AND TRANSMISSION GEAR. NOTE THE DESIGN OF SAME.

LOCAL CASE-HARDENING.

LOCAL case hardening of steel formed the subject of paper read recently by Guillet and Bernard before the Societe d'Encouragement pour l'Industrie National of France. The methods employed were summarized as follows:

1.—The parts to be protected against cementation are covered with fire clay, but the protection thus furnished is not complete, as the gases penetrate the fire clay, besides in complex shapes the method becomes complicated and expensive.

2.—A tube is shrunk over the parts which are to remain uncemented, the thickness of the tube being slightly greater than the depth of case required. After the cementing process the tube is broken off. The method is obviously very limited in its application.

3.—The object is made with extra thicknesses in those parts which must not be hardened, and after cementation and before hardening, these extra thicknesses are machined off . The process is very expensive.

4.—The parts not to be cemented are protected by a metallic deposit which must be (a) solid at the cementing temperature; (b) impervious to the cementing materials; (c) easily obtained commercially, and (d) easily removed after the operation. Copper and nickel are the only metals which fulfil conditions (a) and (c), and the latter fails to comply with condition (b).

The metal may be dsposited by immersion in a salt solution, by electrolysis, or by the Schoop spraying process. The first-mentioned is not satisfactory owing to the thinness and uncertain adherence of the coating. The electrolytic process, is cheaper to install than the spray process, which, on the other hand, is quicker and more easily localized.

Analysis by Sparks.—The spark test of steels in forge shops and tool room is placed next to precise chemical analysis by J. F. Keller, of Perdue University. A chart, 18 by 24 inches in size, has been prepared, and shows the colors and general appearance of the sparks for steel of many different compositions. Comparisons of the sparks with this chart serves to separate iron, mild steel, tool steel, high-speed steel, magnet steel, and so on.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE SET-UPS REQUIRING MULTIPLE TOOLS.

By F. Scriber.

ALTHOUGH the use of a number of cutting tools at once is common manufacturing practice, where special lathes are concerned, the extent to which this usage can be successfully carried out, is often in doubt. The accompanying illustrations show two such applications to turret lathes which make combinations that have secured good results.

Fig. 1 illustrates a method of machining the spur gear shown in Fig. 2, the operations on which are as follows:—The gear is first gripped in a three-jawed chuck with the long hub towards the turret, and the hole spotted with the short drill A, Fig. 1. This drill is held in the turret by the holder B and, at the same time as the spotting is being done, a back facing tool is fed through the spindle to face off the short hub C, leaving the work in the condition shown at the first turret face.

At this point the turret is indexed to the next position, and the set of tools on the second turret face is brought into play. These consist of a two-lipped drill D to open the hole through the piece, a blade E for facing the end of the

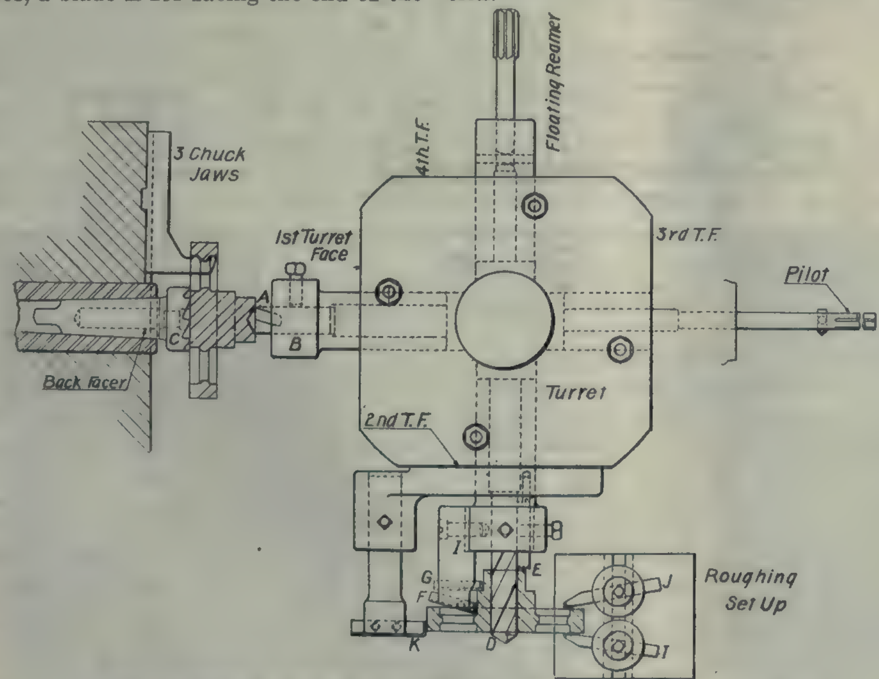


FIG. 1. SET-UP FOR ROUGHING AND FINISHING GEAR BLANK.

long hub and two blades F and G for turning the corresponding diameters of the hub. The last three tools are held in the cast iron holder I. There are also two facing tools I and J, which clean up both sides of the gear. These are held by tool posts to the cross slide of the machine. The periphery or outside diameter is turned by the tool K

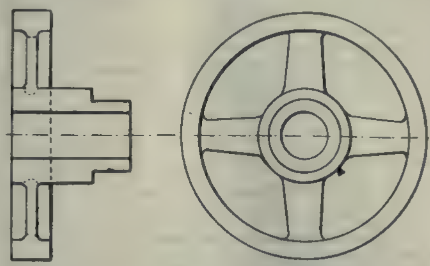


FIG. 2. GEAR BLANK TO BE MACHINED.

which is held in the turret as shown.

This completes what might be called the roughing set-up and leaves the gear in its finished shape but not sized. For finishing the work, a similar set-up is used on the 3rd turret face with the exception of the tool for the bore of the gear. Instead of a drill a boring bar is used having a pilot on the end which is a running fit for the facing tool C; thus tying all the tools on the third turret face to the headstock which prevents chattering and makes a very rigid tool combination for the finish turning operation.

As it is customary to ream these gears after boring, the fourth and last turret face is used to carry the floating reamer and holder. This reaming operation is the last of the four which finish the nine faces of the gear.

In Figs. 3 and 4 are illustrated similar methods for machining a gear case. This requires two large formed mills combined with boring bars and a milling fixture to hold the gears while machining the small diameter face. The work is first gripped by the medium diameter in the three special chuck jaws which are made to just bear on the small diameter of the work and thus steady it while being machined. The piece is roughed by a combination of tools such as is shown in operation on the piece and are as follows:—The small hole comes cored and is bored with the bar A held in the end of the roughing head. The inside is finished by the formed boring head B, which carries the boring bar and is in turn carried in the turret hole.

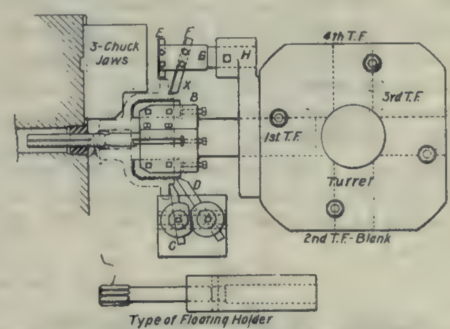


FIG. 3. ARRANGEMENT OF TURRET AND TOOL POSTS FOR MACHINING GEAR CASE.

The end and flange is roughly faced by the facing tools C and D held on the cross slide, while the diameter X and periphery are turned by the blades E and F in the stem G which is held to the turret by the holder H. This completes the roughing operation. The finishing is done by a similar set of tools attached to the third turret face, the second being left blank. The hole is finished by the floating reamer I attached to the fourth turret face.

On this piece, the small diameter could not be faced at this setting, so a gang milling fixture shown in Fig. 4 was designed for the purpose. The fixture provides for four pieces at one setting, and these are held by means of clamps and studs at shown. The cases are slipped over the studs A and are held down by the clamps B, while a surface mill in a ertical milling head quickly faces off the hub, thus completing the machine work on this piece.

When adapting the turret lathe for multiple turning, we have the advantage of a number of tools acting simultaneous-

ly on one piece, a proceeding which may even assist by balancing and steadying the work. Care must be exercised, however, in estimating the ultimate cost of the whole work. The tool cost is fairly high; the setting up and adjusting requires considerable expensive time and, while arranged for a particular job, the machine can seldom be used for anything else. Although the time of actual machining is much reduced, the savings on a considerable number of pieces are required to pay for the set up and extra tools.

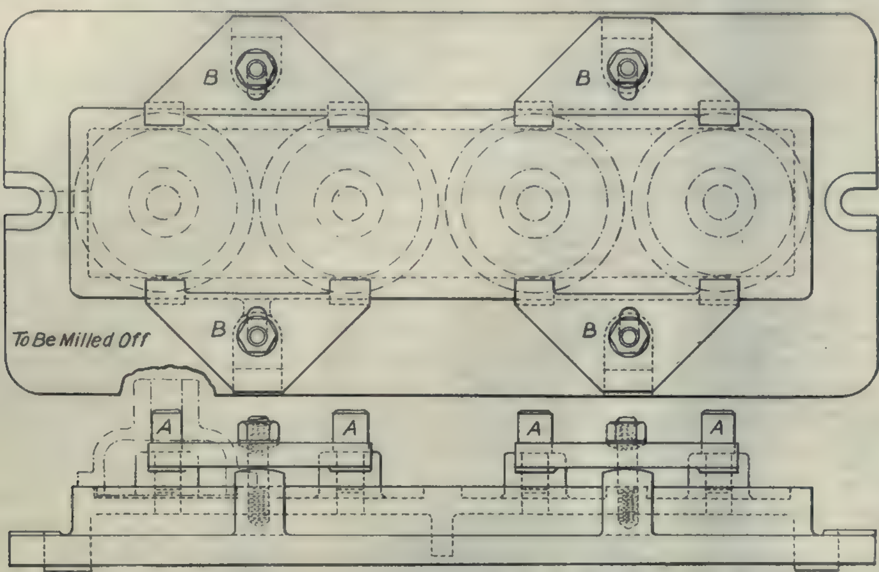


FIG. 4. MILLING FIXTURE FOR FACING HUBS OF GEAR CASE.

CRANK SHAFT KEYSEATING FIXTURE.

By D. O. Barrett.

THE crank shaft shown in Fig. 1 was used in large quantity production of 1½ horse power gasoline engines, the diameter of same being 1¼ in. with a 5/16 in. keyway. The crank pin was of the same diameter. The shafts were to be keyseated in multiples of four on a plain milling machine and, in order to make time, is was necessary to eliminate all false movements and get them into and out of the machine as quickly as possible.

The main fixture is shown in Fig. 2; this consisting of a casting bored out to take the four shafts at the proper distance apart, the outer ones being spaced 2¼ in. while the inner ones were but 2 in. It will be noticed that the casting was cored out from below and in this space was located the clamping mechanism. Feet extended on either side by which the fixture was clamped to the table, a locating key fitting the centre table slot. A ¾ in. slot was milled lengthwise through the centre of the casting at the top, between the holes for the outer shafts and down to a little below the centre of these holes. In this slot were placed the two T-head clamping bolts, these being bored on the ends to conform to the contour of the shaft. These bolts extended down through the body of the casting, the holes for same being drilled 1/32 in. large to allow the bolts to adjust themselves on the two shafts. In the space at the bottom these bolts extended through a 1 in. x 1¼ in. machine steel tie bar, and were provided with locknuts for adjusting purposes. On each side of this tie bar was a ⅜ in. x 1¼ in. cold drawn steel bar which was slightly upset at the one end to form a bearing against the under side of the casting. These bars extended out through the end of the body and were hinged to the tie bar at the centre, while a 1 in. piece was riveted between the outer ends.

It will be seen that any downward pressure on the end of this clamping bar would exert a downward pressure on the T-bolts through the medium of the tie bar. This downward pressure was obtained by means of an eccentric. Two ears were extended out from the main casting, and between these the eccentric was placed, this with the handle being a one-piece forging. Heavy springs under the heads of the clamping bolts served to raise the entire clamping mechanism when the lever was turned to the position shown.

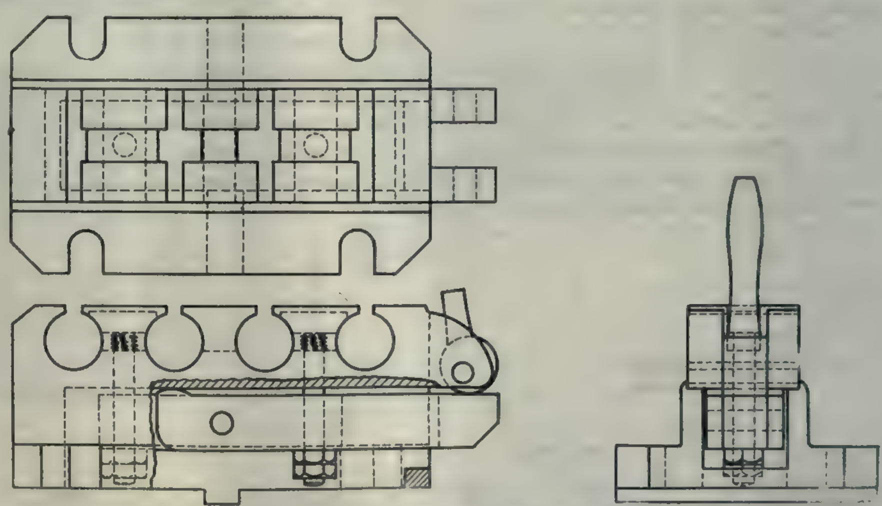


FIG. 2. MAIN KEYSEATING FIXTURE.

In Fig. 3 is shown the device for clamping the outer ends of the shafts, the same casting being used as for Fig. 2 . After the holes had been bored for holding the shafts, the top portion was planed off as shown. The clamping bolts were long enough to extend out over and rest on the tops of the shafts, pulling them straight down into their seats. When the clamping device was released, the T-head clamping bolts are given a quarter turn when the shafts may be slid back out of the first fixture and then lifted directly out. Both of these fixtures were bored out with the same settings so that the relative positions of the shaft holes with respect to each other and the locating keyway at the bottom would be exactly the same.

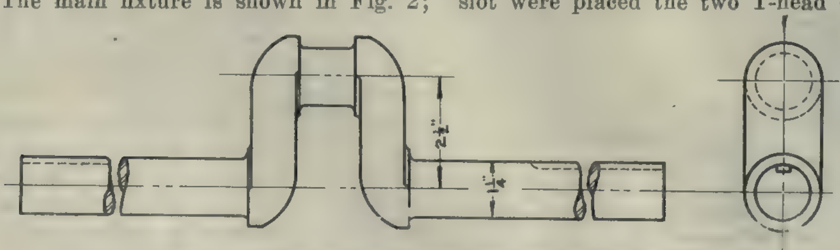


FIG. 1. TYPE OF CRANKSHAFT TO BE KEYSEATED.

These shafts were keyed with the

throw of the crank so that they had to stand vertical while being keyseated. Any tilting to one side would displace the keyway from its proper position relative to the crank and this, in turn, would cause the balance weights in the flywheels to be thrown either forward or back. The device shown in Fig. 4 was used to bring the pins into their proper locations. The main casting was bolted to the two outer table slots next the body of the machine. The piece A was of 1 in. cold drawn steel with a ½ in. pin in the outer end to act as a handle. When this piece was pushed up and back, it would assume a position slightly back of the vertical, due to the angle at which the end was cut. When the cranks were placed in the clamping fixtures, the pins were brought as near as possible to the vertical position, the inner crank being pushed against the finished pad on the casting. The piece A was then brought down, which action placed the pins the proper distance from each other and threw the cranks to the vertical position, after which they could be clamped, this being accomplished by merely pulling down the cam levers at the ends of the fixtures.

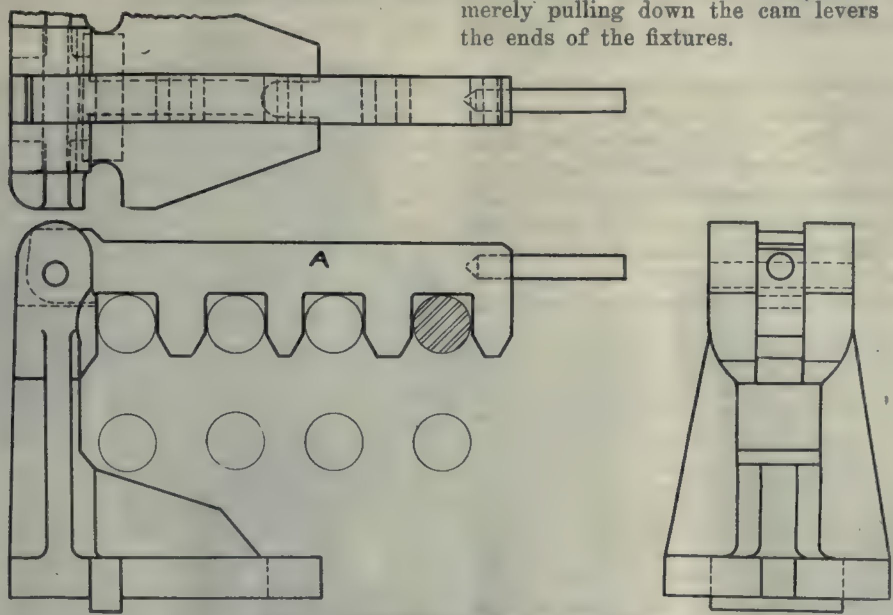


FIG. 4. LOCATING DEVICE FOR PINS.

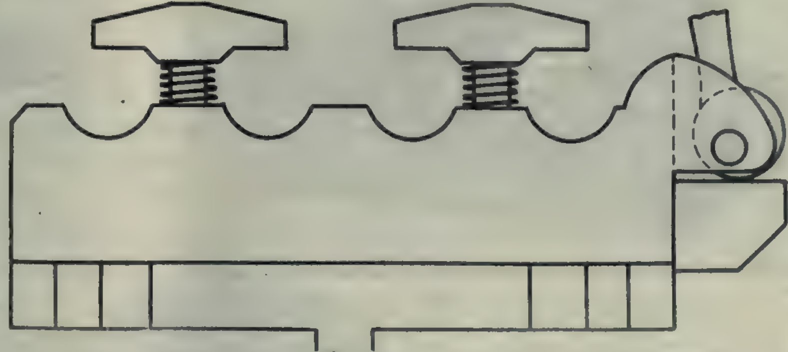


FIG. 3. CLAMPING DEVICE FOR OUTER ENDS OF SHAFTS.

A SHAPER TOOL.

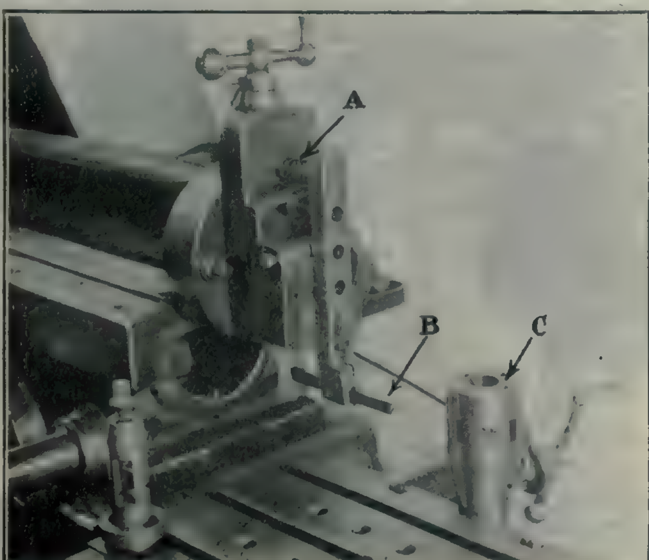
By L. B. E.

A shaper tool here described will be found very useful in the toolroom. The regular toolpost is removed and the tool bolted to the clapper block. A spring at A gives a quick return. The cutting tool B is so clamped into the split end of the holder that it may be turned in various directions when shaping out an odd-cornered or any kind of hole. The tool is especially good for boring bar slots, in which case the bar may be clamped to the shaper table as shown at C.

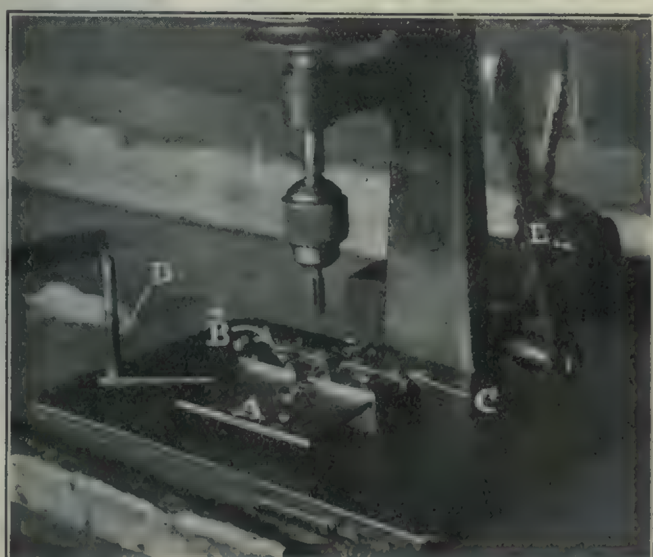
REAMING SMALL GEAR BLANKS.

By A. E. Granville.

THIS drill press fixture is used for reaming small brass gear blanks, which are made from round bars in a screw machine, being drilled and cut off. The thickness is not so important as the other dimensions. A handful of the drilled blanks is placed in the tray A and are pushed in between the vise jaws B and C with the fingers of the right hand, while the movable vise jaw is worked with the left hand on handle D. As the reamer is brought down by means of handle E, it will be seen that it is impossible to injure the fingers by jabbing the reamer down on them, since the spindle flies up the instant the lever is released. This device is not only rapid and convenient for reaming the work shown, but may be used for small collars, washers, nuts or other similar work.



A SHAPER TOOL.



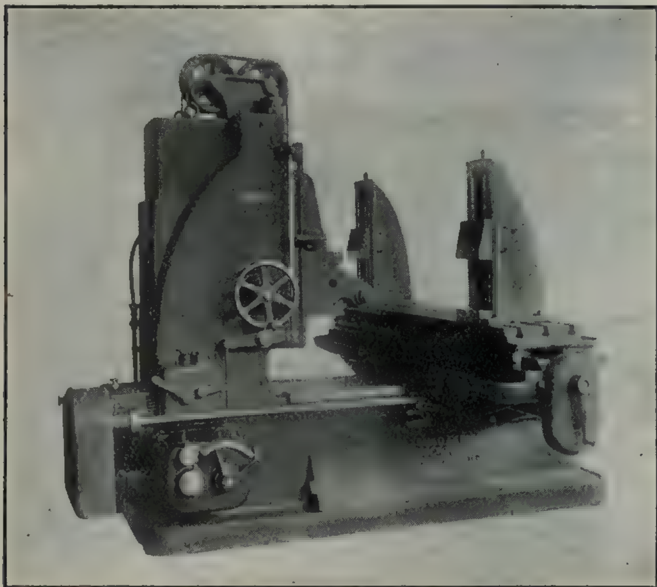
REAMING SMALL GEAR BLANKS.

PROGRESS IN NEW EQUIPMENT

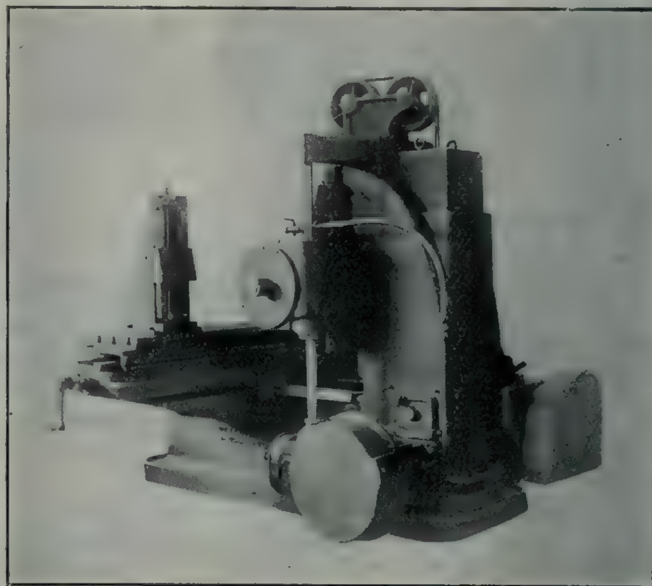
A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW STYLE RACK CUTTING MACHINE.

ANOTHER size rack cutting machine of their so-called light type has recently been brought out by Gould & Eberhardt, Newark, N.J. It has a capacity for cutting racks 60 in. long by 10 in. face, up to $1\frac{1}{2}$ d.p. in cast iron and 2 d.p. in steel. The make-up consists of the firm's 60-in. by 16-in. vertical cutting gear cutting machine with the substitution of a rectangular work table for the ordinary circular work, and the addition of an extra auxiliary cutter spindle. It is an automatic rack cutter in every sense of the word, but has additional commercial value in being readily convertible to the standard 60-in. by 16-in. spur gear cutting machine, by the substitution of the regular circular work table and carriage. The work table indexes automatically and, while the indexing is being performed, the cutter slide is locked so that it cannot feed down until the indexing is complete. Single or gang cutters may be used and the machine will index automatically for the number of cutters being used at one time. The work table indexing screw is extremely accurate and a micrometer is provided so that table with rack being cut can be moved slightly without disturbing the indexing gears. This makes it possible to cut racks longer than the machine is rated to do, or it will cut sections of racks that are to be matched together as one long piece.



NEW STYLE RACK CUTTING MACHINE

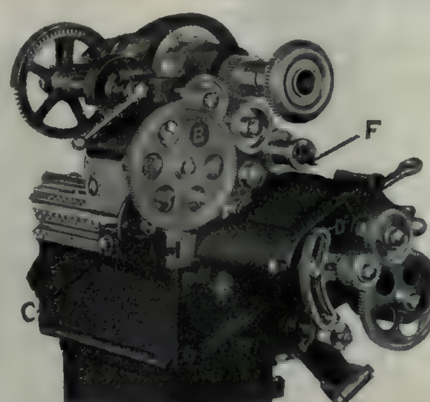


NEW STYLE RACK CUTTING MACHINE

The illustrations show two vises mounted on the table, although these are not regularly furnished with the machine. They illustrate how several racks can be mounted on top of each other. The indexing mechanism is positive, and there are 16 changes of feed which may quickly be had by means of a very compact feed gear box. A wide range of cutter speeds is also available. Only one belt is required to drive the entire machine, and the driving pulley is completely enclosed in a neat guard; all running gears are enclosed. For the accommodation of plants who may not have enough rack work to keep a machine like this busy, an indexing table for cutting spur gears or spur and bevel gears can be furnished, and as it only takes a few minutes to change over for cutting either racks or gears, the machine is ideal for both manufacturing and gear jobbing.

QUICK CHANGE SWING PRECISION LATHE.

HARDINGE BROS., INC., Chicago, Ill., have recently added to their line of products what is known as the Cataract quick change precision lathe. Quite a number of interesting features are to be noted in the general and detail design and construction of this machine, and these, the accompanying text and illustrations will serve to make more prominent.

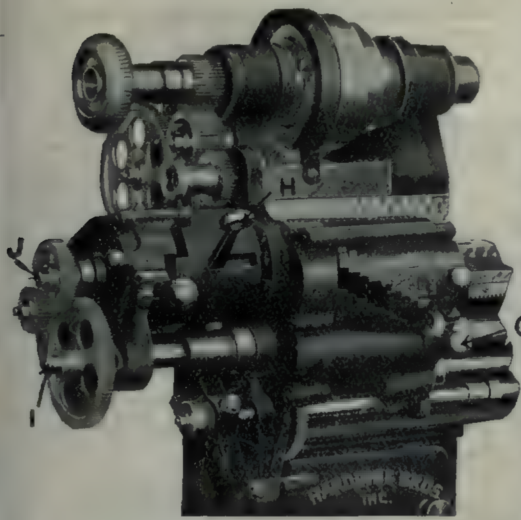


Q.C.S.P. LATHE DETAIL.

The back-geared type head is 12 in. long, and is constructed with adjustable journals, the front one being 2 in. long and 2 1/32 in. in diameter. The base of the head is planed to interchange with standard Cataract bench lathe beds, and the spindle end-shake is taken up between the housings by means of a patent end shake take-up nut, thus making it practical to use ball bearing thrust. To the head has been added an auxiliary sleeve, upon which the cone pulley revolves when the back gear is used. This allows the cone pulley to have proper end shake, while the spindle remains adjusted to practically no end shake owing to the use of the ball bearing thrust. The oiling and dust cap protection are the same as for the firm's bench lathes. The cone pulley diameters are 3-½ in., $4\frac{3}{4}$ in., and 6 in., for $1\frac{1}{4}$ in. belt, and the lathe head is designed for a safe spindle speed, of 1,500 r.p.m.

The spindle is $15\frac{1}{2}$ in. long with a $1\frac{1}{4}$ in. hole clear through, and is hardened and ground. It is designed with a patent spindle nose, and is provided with a

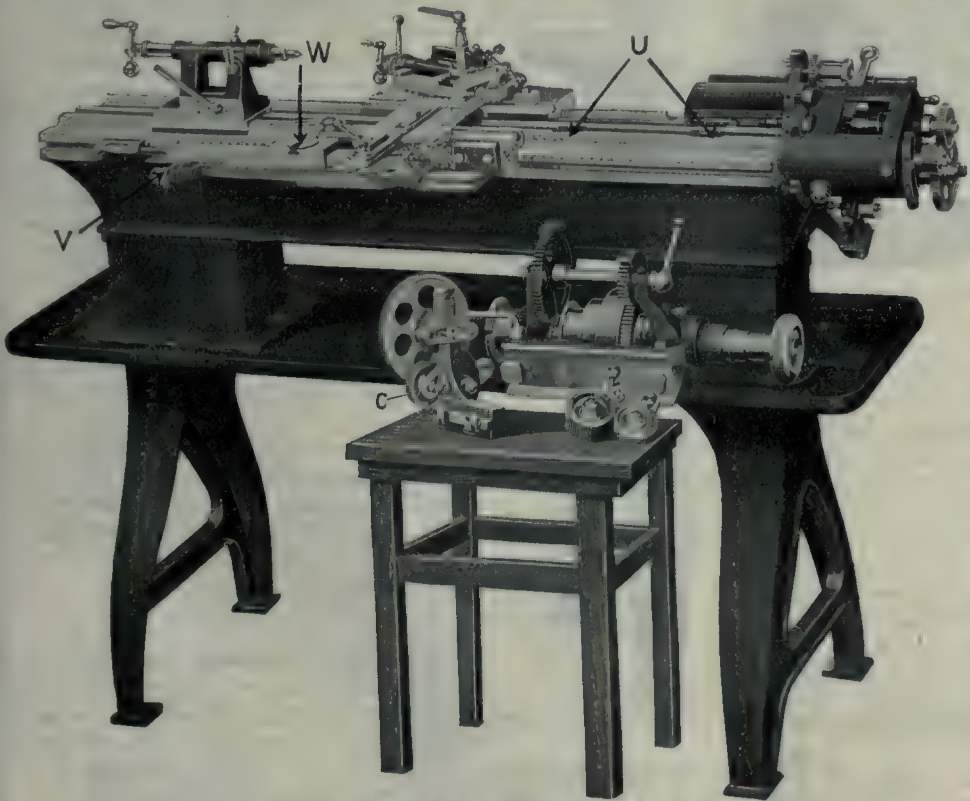
safety locking device for three-jawed chucks and face plates so that they cannot come off while the spindle is in motion, should they be improperly put on.



Q.C.S.P. LATHE DETAIL.

The draw-back chuck has a 1 in. capacity clear through.

The bed is 52 in. long, 8¾ in. wide by 7½ in. deep and its casting weight is 230 pounds. It has one large way in front and one flat way in rear for carriage, while the centre is fitted to the standard Cataract bed. It has a much heavier tee slot than the bench lathes,



QUICK CHANGE SWING PRECISION LATHE.

consequently, turrets, milling attachments, etc., may be used by simply changing the draw bolts. A tee slot is planed in back of the bed into which the taper turning attachment "bed bracket" is locked, also the carriage gib and lock. This also admits the bracket A for extra fine feeds, the 15 in. swing connection, also the relieving attachment bracket for the driving cone pulley.

The gear box bracket is attached to the end of the bed and contains all gears excepting the one on the spindle. It is, therefore possible to change the swing of the lathe from 9 in. to 15 in., without interfering with the arrangement of the gears by simply adding the bracket B, containing two connecting gears; everything is then in readiness for feeds and thread cutting. In removing the head when changing from 9 in. to 15 in. swing, its and the raising block binding bolts pass through the oblong slots U so that it is a simple matter to put on and take off the heads without interfering with either the end gearing or the carriage. The tail stock has a bearing surface on the bed of 7 in. It has two inner and two outer angular guiding surfaces, making 2 in. of wearing surface, also two flat surfaces ⅝ in. wide, or a total wearing surface of 3¼ in. by 7 inches.

The carriage is 19½ in. long and the ways are protected by wick let into each corner by recesses cut into the carriage. Oil is thereby constantly supplied and the ways are always wiped and oiled. This method makes the wick easy to replace, besides, it can never be lost and is out of sight. The travel of the carriage is controlled by adjusting stops T and S and stop collars L and N., while a clutch eliminates the possibility of engaging the lead screw nut and feed rod

Q.C.S.P. LATHE DETAIL.

simultaneously. Q. and P. are power feed controls while O represents a graduated friction vernier, which magnifies the travel of the tool four times. This makes the recessing of a hole for internal work conveniently read.

The apron mechanism is entirely encased having double bearings throughout and the oiling is carefully attended to. In all places, both in apron and gear boxes, where wear on shafts is the greatest, are hardened bushings running loosely, consequently there are two separate journals, and in case one should bind the other relieves it until it becomes lubricated. Oil wells are provided everywhere possible. The cross slide surface is 11 in. long by 4⅛ in. wide, and is fitted all over. The cross slide nut is 2½ in. long. The long slide will keep true and is in proper proportion for the 15 in. swing.

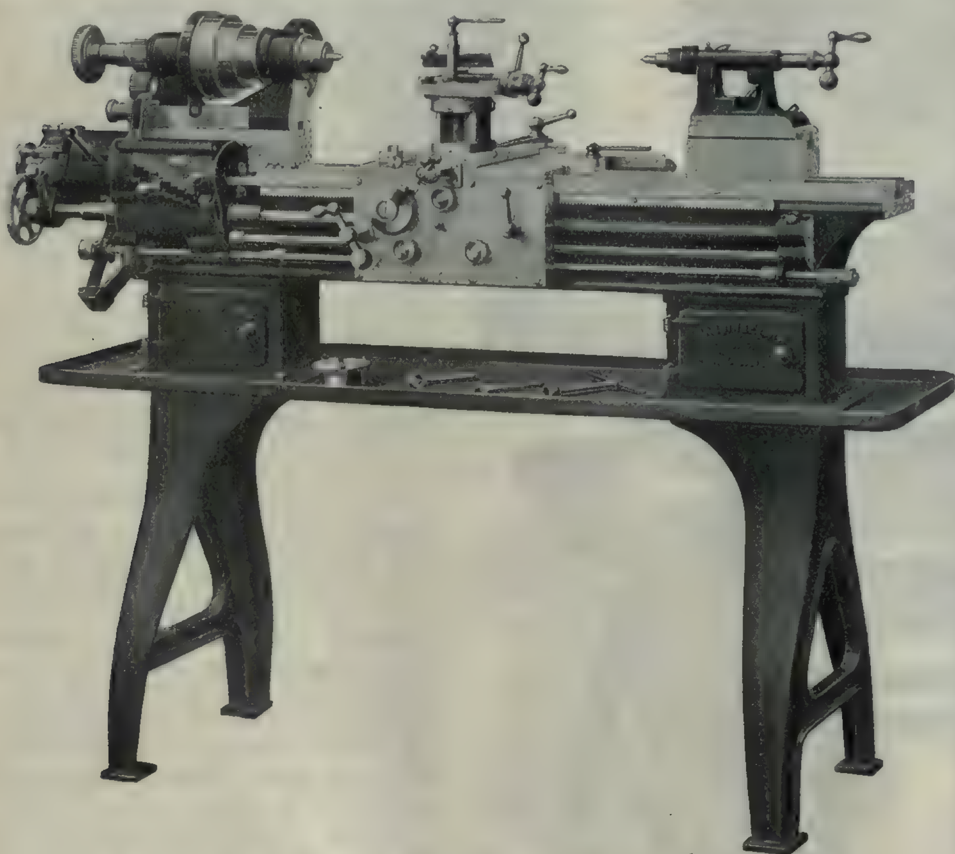
The compound slide is equipped with a quick-acting graduated nut requiring one-half revolution of the handle to advance the slide 5/32 in. to a solid stop in either direction. This will be found exceedingly convenient in cutting threads external or internal or for turning operations, and does not interfere with regular uses of compound slide screw, which, on this machine, is supplied with adjustable indexes graduated in thousands of an inch.

The taper turning attachment of the carriage, is constructed to be detached readily, allowing removal of the cross slide for inserting raising block bolt for compound rest. This attachment may be used on work up to 15 in. in length and is adjustable to ten degrees by a fine pitch screw. The relieving attachment is applied by using a large gear upon the patent spindle nose, which drives left or right using the spindle as an arbor, and

is driven by a pinion through a set of change gears and an extra cone pulley back of lathe head, supported by a bracket held on to the lathe bed by the tee slot in the rear. This pinion operates the cam which works the cross slide to any division of the large gear desired. The cam is supported by the main bracket of the taper turning attachment and is fastened to the cross slide by the same bolt as the top slide of the taper turning attachment; thus it is easily rigged up and is suitable for relieving cutters or taps.

The change gear box consists of a nest of nine gears, 48 to 80, and through the lever manipulation, twenty-seven changes in thread are possible. Other threads are cut through different combinations of gears on stud J and screw I with lever in lock-out position, or when necessary through compounding on bracket D. All gears of 80 teeth and under are made of steel both in gear box and apron. Bracket B, attached to bracket A, is for connecting spindle gear with change gear mechanism when head is raised to 15 in. swing, and bracket C, also attached to bracket A, carries intermediate gears for connecting 2 or 3 to 1 reduction feed gear, through gear F. The regular feed of carriage is 200 per inch. The metric bracket shown is set for 10/100 m.m. pitch.

The lead screw can be replaced or exchanged in a few minutes without disturbing the change gear mechanism, and with the change gears, revolves on the roller bearings. The pitch is 6 per inch, the diameter 1 in. without a spline, and is translated constantly to 10 per inch by the gears in reversing box. The lead screw nut is $3\frac{1}{2}$ in. long. The countershaft is of the 2-speed clutch pulley type, the pulleys being 7 in. in diameter by $1\frac{3}{4}$ in. face.



QUICK CHANGE SWING PRECISION LATHE.

RAILROAD BUILDING STATISTICS.

FOR the first time in its railroad history, the United States has been exceeded in the mileage of new railroad built during the year, according to statistics compiled by the Railway Age Gazette and published in its Annual Review.

In 1914 the total mileage of new railroads constructed in the United States was 1,531, as compared with 3,071 in 1913, while the Canadian roads built 1,978 miles, as compared with 3,010 in 1913. Not only is the total for the United States only about half of that for the year before, but it is the lowest for any year since 1895, and only about 25 per cent. of that for 1902, the high record year.

Cars and locomotives were built in the United States as follows: Freight, 104,541, against 207,684 in 1913; passenger, 3,691, against 3,296; locomotives, 2,235, against 5,332. The number of cars ordered is lower than for any year since 1901, except 1908, when only 62,669 freight cars and 1,319 passenger cars were ordered. The number of locomotives ordered was also less than for any year since 1908.

On December 31, 1914, 21,048 miles of road, with a total funded debt of $830,728,790, and a total capital stock of $434,599,738, were in the hands of receivers. In no year since 1896 has there been so great a mileage of U. S. roads in the hands of receivers.

The number of men employed on twenty rialroads on June 30, 1914, was 809,929, a reduction of 69,563, or 7.9 per cent. On August 1, 1914, the number was 764,827, a reduction of 90,934, or 10.8 per cent. from the similar date the year before. The total number of employees in thirty-four railroad supply companies in December, 1914, was 32,266, a reduction of 57,378 from the normal force, or 64 per cent.

ONTARIO WORKMEN'S COMPENSATION ACT.

THE Ontario Gazette contains the undermentioned announcement respecting the Workmen's Compensation Act of the Province of Ontario: The Workmen's Compensation Board hereby makes the following regulation:—

51—Any employer failing to pay assessment or special assessment, or any prescribed portion thereof, within fifteen days after notice thereof has been mailed to him by registered post, shall pay as a penalty for such default 5 per cent. of the amount unpaid; and, where default continues longer than one month after the expiration of such fifteen days, shall also pay as further penalty an additional one per cent. of such amount for each calendar month or fraction thereof such longer default continues. The regulation is approved by the Lieutenant-Governor in Council.

The Workmen's Compensation Board adopted the above regulation so as to provide a slight penalty for those employers who deliberately held back payment of their assessments, and thereby injured the proper operation of the Act. The Board wants to have all assessments paid promptly, either on the instalment option or in full, by the time such payment expires.

Want Own Accident Act.—Ontario lumber mill operators are apparently not satisfied with the provisions of the new Workmen's Compensation Act, and have applied for a charter to form an Accident Prevention Association of their own, under the provisions of the new Act. A meeting may be held by the mill men shortly, in order to get suggestions for amendments into shape. W. E. Bigwood and Walter E. Laidlaw are Toronto representatives on the committee.

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Vol. XIII. JANUARY 14, 1915 No. 2

PRINCIPAL CONTENTS.

AN OPPORTUNITY FOR MACHINE TOOL BUILDERS.

RECENT statistics show that the greatest number of articles of machine shop output have been produced by turret lathes, and that the greatest amount by weight has been turned out by boring mills. This, of course, refers to the United States more than to Canada, and probably is not the condition in the latter country. Both these tools are developments of the ordinary lathe and have reached such a stage of perfection that their output is of the highest order in comparison to the amount of labor required of any other machine tool.

Neither of these machines are made in Canada, therefore, the particular class of work to which they are eminently adapted must be done at a serious disadvantage or the machines imported to produce it. There seems, however. to be no logical reason why they should be more difficult to build than many others that are successfully made and sold, and whose demand cannot possibly show an equivalent increase in comparison with those whose advantages are that they not only produce in greater quantity and of superior quality, but are such that less expensive labor can be utilized on repetition work.

Canada is rapidly becoming a manufacturing country and the manufacturing type of machine tools are likely to be more generally required, comparatively with those of the jobbing type.

ADVERTISEMENTS AS EDUCATIONAL HELPS.

HOW often do we meet a mechanic whose greatest ambition is to send his boy to college and thus open up for him opportunities which did not exist in his the father's time. The boy, after having passed through the University, finds, however, that the value of technical education in itself was greatly over-estimated by his father and that its worth depends largely upon its ability to assist him in securing a practical education. He finds that his usefulness to an employer who needs an executive is measured largely by his knowledge of the comparative value of different brands of packing, the characteristics of similar machine tools built by different manufacturers, and other such facts.

The mechanic of to-day has a splendid opportunity to acquire the education that will be envied him by the purely college bred man, and one source of such learning is the advertising section of the better class technical journals. A comparison of the current numbers with those of but a few years ago cannot fail to convince one of the vast increase in educative value which they now contain. Those responsible for product publicity are realizing more and more that to serve their purpose, advertisements must be attractive, and to fully attain this condition, they must be instructive. In a valuable paper presented before the University of Toronto Engineering Society, it was admitted that a large number of the illustrations accompanying the paper were obtained from the advertising columns of periodicals.

The crusade against fallacious advertising as evidenced at recent conventions of technical and trade journalists and newspapermen, indicates a determination to make the advertising section reliable, attractive and instructive to the reader besides being supplementary to the editorial columns. Endeavor is being made not only to make known the existence of the advertised articles but to educate the public in the best methods of using them. Thousands of dollars are being spent weekly in making photographs and in preparing data. Advertisements of machine tools not only illustrate the latest types of this specialty, but feature as well the different types of accessory equipment and tool set-ups, and those of other specialties are equally pronounced along the lines indicated.

It is true that the majority of advertisements have not yet reached the highest stage of educative value but where this is lacking, the advertisers are usually glad to furnish the fullest information on request. In this as well as in all other reading matter it is of course necessary to separate the wheat from the chaff, but the field even now is white to the harvest, and the information to be gained is of the kind that distinguishes between man and man.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X......	18 00	17 00
Victoria, No. 2 Plain..	18 00	17 00
Hamilton, No. 1.......	18 00	17 00
Hamilton, No. 2.......	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal.	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 75
Copper, crucible	10 00	9 75
Copper, unch-bled, heavy	9 50	9 75
Copper wire, unch-bled	9 50	9 75
No. 1 machine compos'n	8 50	8 75
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70
Miscellaneous wire nails... 75 per cent.		
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.

Nuts, square, all sizes....4½c per lb. off

Nuts, Hexagon, all sizes.4¾c per lb. off

Iron rivets .... 75 per cent.

Boiler rivets, base, ¾-in. and larger. $3.25

Structural rivets, as above 3.15

Wood screws, flathead, bright ......85, 10, 7½, 10, 5 p.c. off

Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off

Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in. ..	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in. ..	70%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload ..	$14 25	$14 00
Electrolytic copper	14 00	13 75
Castings copper	13 75	13 50
Spelter	6 25	6 00
Tin	37 00	36 60
Lead	4 85	5 00
Antimony	17 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in...	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ..	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings. 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.58
Linseed oil, boiled, single bbls.	0.61
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 08
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 11, 1915.—The last week has witnessed a revival of business in all lines after the period of holiday dullness. Metals have been particularly active, the tendency to stiffen in price being a feature. On account of the present controversy between the United States and Great Britain, copper has been brought into the limelight, and a sharp rise in price is the result. The steel interests report an increase in business, and everywhere there seems to be an optimistic spirit prevailing. The iron ore and pig iron business is still very slack, but other industries seem to be holding their own.

The influence of the war has reduced the purchasing power of the larger institutions to an extraordinary extent, necessitating economy being practised in every way possible. The very best that is in us is, however, being brought out by these strenuous days and, with the return of normal times, our manufacturing enterprises will be found to have become established on a firmer and more substantial basis than ever before. As with everything else in the world worth having, we must, however, pay the price.

The Steel Market.

The railroads of the United States have been placing more or less business lately with the steel companies, the orders being a direct result of the five per cent. increase in freight rates. The oders consist largely of rails and freight cars. A number of new locomotives are also on order. In Canada, this freight rate increase has not resulted in any actual business, but it has greatly stimulated the number of inquiries received, and it is only reasonable to assume that some of these inquiries will have favorable results.

The Allies still continue to place extensive orders for munitions of war with Canadian firms. Production of the necessary forgings has been allotted to our various steel companies, while the machining of the shells has been quite largely distributed. There is not much doing in machinery steel, but structural material is moving a little more freely than for some weeks past.

Pig Iron.

Very little business is moving in the iron ore and pig iron business; prices have, however, been maintained.

Machine Tools

Business in machine tools continues to be very quiet, sales since the beginning of the year having been very light. It is expected that business will pick up as the spring approaches. Supplies are moving freely, although the sales are usually of the small lot variety.

Metals.

Copper trading has excited a great deal of interest of late and, in consequence of an increased demand, the price has stiffened and everything seems to point to a further advance. Spelter, too, has taken an upward jump. The market in tin has been rather inactive and no change in price has occurred.

The price of lead has dropped a little due to overproduction. The belligerent nations are not apparently consuming as much lead in their ammunition as was previously consumed by industries which have had to cease operating on account of the results of the war. Thus, the overproduction is reducing the price. Antimony experienced a little stiffening during the week.

More or less activity continues to prevail in the metal markets as we go to press, and further changes are anticipated during the present week.

Toronto, Ont., Jan. 12, 1915.—There has been considerable dullness in business circles during the week and this is likely to continue for some time to come. This month and February are usually quiet periods, but they will be more so this year. The spring should, however, see an improvement in the outlook. Many industries are quiet and the general tendency to economize is naturally restricting the volume of business. An improvement can hardly be expected until the war outlook brightens and optimism becomes more in evidence. Most people are confident in the ultimate return of prosperity, but it is the uncertain outlook for the immediate future that is having a depressing effect on business. There is no lack of Government orders for war equipment, which helps to relieve the situation in some industries. These orders will no doubt continue to be placed for some time to come so a certain amount of business is assured. There is in addition the prospect of other industries being benefited as a result of the war. This latter phase of the situation will take a longer time to develop, but will perhaps be more permanent in its effect.

The shortage of shipping has caused a big advance in ocean freight rates; these in some cases having gone up over 50 per cent. The falling off in ocean traffic, particularly in the import trade, will make the increase in freights not so much of a burden as would otherwise be the case. A new and higher tariff has been agreed to by the U. S. Interstate Commerce Commission which will affect goods coming into Canada from the States. Manufacturing and mercantile interests are protesting and the matter is under advisement by the Dominion Railway Commission insofar as it affects Canadian interests.

There is considerable activity in machine tools on account of developments in the shell industry. The steel trade is quiet and prices are unchanged, but firmer. The scrap metal market is stagnant, very little business being done, with prices stationary. The demand for pig iron is light and prices unchanged. The metal markets are quiet, and consumers are buying only to fill immediate requirements which are light; prices are unchanged but firmer.

Steel Market.

Dullness has marked the iron and steel trade this week and it is too early in the year to expect any noticeable improvement, especially under the present conditions. The building trade continues very slow and is likely to remain so for some time to come, that is, until financial conditions improve materially. There is practically no railroad construction being undertaken and structural steel plants are quiet. This is a not unusual seasonal state of affairs, although this year it is more accentuated. A few contracts are being made by manufacturing interests, but immediate requirements are not heavy. The chief item of interest in the steel trade is shell manufacture, and it has been stated that the amount of this business depends entirely upon the ability of our plants to produce. Satisfactory progress is being made and large orders are being placed.

The general tone in the steel market in the United States shows continued improvement and prices on bars, plates and shapes have stiffened. Prices locally are unchanged but firmer. The Steel Company of Canada recently started another open hearth furnace at Hamilton and the Algoma Steel Co. of Sault Ste. Marie has booked an order for 15,000 tons of rails for a U. S. road at a price lower than the market level there.

Pig Iron.

There is little to be said with regard to pig iron, as the market is so dull. Most foundries have started operations again after the holidays but as a rule on short time; their requirements, therefore, are not heavy. There has been no change in prices this week.

Machine Tools.

There is a certain liveliness in machine tool circles over the new shell industry, but for which business would be very dull. In the majority of cases, firms taking orders for shells have to buy suitable tools to ensure rapid production and accurate workmanship. The number of firms engaged upon the work is increasing, and with it the demand for tools, which consist principally of turret lathes, grinders, hydraulic presses for the copper rotating bands, and furnaces for the heat treatment. A number of orders for equipment have been placed and others are pending. The demand for machine shop and mill supplies is light, orders generally being in small lots for immediate requirements.

Metals.

Business locally is very quiet in the metal markets, many consumers are operating on short time and their requirements are consequently light. There has been no change in prices but there is a firmer tone throughout. The copper situation is improving and the market is strong with a prospect of higher prices. The present price is 13½c to 14c per pound. There is an optimistic feeling in the tin market which is firm at advanced prices in London. The price here, however, is unchanged at 36c per pound. Spelter is firm at 6c and lead quiet at 5c per pound. There appears to be a worldwide scarcity of antimony which has caused an advance in the New York market; the price locally, however, is firm at 18c per pound. Aluminum is unchanged at 22c per pound.

CANADA AS A WHEAT PRODUCER.

ONE year ago Canada was fifth in rank among the wheat-producing nations of the world. This year she surrendered her place to Italy, who stood sixth in 1913, Canada being sixth in 1914, with 158,000,000 bushels, compared with Italy's 169,442,000 bushels.

In 1914 the United States led the world in production by a margin of 111,000,000 bushels, Russia coming second with 781,000,000 bushels. The first seven producers other than Canada in order of rank follow:

	1914.	1913.
United States	891,950,000	763,380,000
Russia	781,000,000	962,587,000
British India	313,040,000	356,864,000
France	295,000,000	321,571,000
Italy	169,442,000	214,405,000
Hungary	125,000,000	151,348,000
Argentina*	113,717,000	198,414,000

*Broomhall's estimate 1913-14 crop.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

MACHINE TOOLS IN TRINIDAD.

A RECENT British trade report states that machine tools are used to a considerable extent in Trinidad, possibly as much as in most agricultural countries where there is no general manufacturing. Such tools will be found principally in the automobile garages, the Port of Spain foundries, the Trinidad Government drydocks and workshops, the shops of the Trinidad Government railway, the Trinidad Electric Co., three furniture factories, one carriage factory, two lumber mills, on the large sugar-manufacturing estates, and in the shops of the asphalt and oil companies.

A large proportion of the machine tools are imported from the United States, although some are brought from England and Germany. The market for such tools is good, although limited. With the prospective development in the oil industry, it may reasonably be expected to increase considerably in the near future. Some lines of tools are ordered through travelling salesmen, and some direct from the manufacturers, but the sales are usually made through New York commission houses. Tools are mostly imported by a few houses who wholesale to country districts or retail to meet the demands, as items in a general trade, without commission, discount, or special terms of sale. There is very little attention given to advertising to advance sales in such goods. Machine tools are now imported and carried in stock by four Port of Spain firms, and used by over a dozen. Some of the users of such tools import them direct.

RUSSIAN AGRICULTURAL MACHINERY MARKET.

SINCE the middle of August last, says a U. S. consular report, the imports of agricultural machinery into Russia have almost entirely ceased. Through northern Finland occasional small shipments, mainly of harvesting machines, come in. They are all made in Sweden by Swedish firms and by the branch house of an American concern. In the future Russia will be able to get, via Norway, Sweden and Finland, complex steam threshers and engines from England, harvesting machines and disc harrows from the United States, and harvesting machinery from Canada.

It does not seem probable that any agricultural machines will come in via Archangel, as through that port there enters principally raw metal and coal. During the month of July agricultural machinery was brought in through the Black Sea ports. The only route that remains is via Vladivostock, through Siberia and Nikolaiefsk, on the Amur, but such transportation is difficult because of the high rate of insurance, the high cost of freight through Siberia, and the question of credit, which applies to all routes. The following table shows the decrease in imports of agricultural machinery in July last, as compared with July, 1912 and 1913:

Articles.	1912.	1913.	1914.
Machines for tilling	$ 186,000	$ 287,000	$101,000
Drills	190,000	99,000	6,000
Harvesting machinery	78,000	196,000	21,000
Thrashers	695,000	728,000	222,000
Grain cleaners and sorters	41,000	63,000	15,000
Fodder machines.	42,000	28,000	500
Motors	695,000	741,000	285,000
Other articles	391,000	521,000	168,000
Total	$2,318,000	$2,663,000	$818,500

In the first half of 1914 there was an increased importation of agricultural machines and implements in the following custom house groupings: "Other machines," tilling machinery, and grain cleaners and sorters. The first group represents "agricultural machinery not specially designated by the customs," of which the following imports are recorded: Six months of 1914, $2,678,000; of 1913, $1,854,000; of 1912, $1,390,500.

OPPOSITION TO FREIGHT RATE ADVANCE.

IT is more than likely that many of the large mercantile and manufacturing establishments of the Dominion will be represented at a hearing of the Dominion Railway Commission, the date for which has not yet been fixed, to protest vigorously against the new freight rate schedule granted by the Inter-State Commerce Commission to eastern railways. The new tariffs are in accordance with the five per cent. increase granted by the United States Commission and will become effective on January 15. Canadian business men state that their grievance is owing to provisions made in the schedule with regard to rates from United States points to Canada. It is said that the new rates are not in conformity with those recently acquiesced in by the United States and Canadian Commissions.

The Traffic Department of the Toronto Board of Trade, members of the Canadian Manufacturers' Association, and similar organizations throughout the Dominion are taking the matter up, and unified action on their part when the Dominion Railway Commission considers the schedule is likely.

Under the new schedule, the rate to Canadian destinations, first class, from New York, will range from 59.9 cents to 78.8 cents a hundred pounds, and it will be the same from Baltimore and Philadelphia. From Albany to Canadian points the first-class rate will change from 41.1 cents to 63 cents, and from Syracuse and Rochester from 41.9 to 55.5 cents.

The tariffs provide that from New York to all Canadian points via People's Line Steamers and rail via Rouse's Point, N.Y., not less than standard all-rail rates shall apply. To points taking higher than 78 per cent. of the class rates in traffic moving by way of Long Island Sound, New London, Conn., Boston or Portland, Maine, a differential of 8 cents a hundred pounds lower than the standard all-rail rate is established, with proportionately lower differentials on other classes.

BRITISH COLUMBIA DEVELOPMENT

MORE than $26,000,000 were spent in British Columbia in 1914 on railway construction according to an announcement by Sir Richard McBride. On the Canadian Northern, the expenditure was $8,195,000; on the Pacific Great Eastern, $12,885,000, and on the Kettle Valley, $5,000,000.

The output of British Columbia's mines in 1914 is estimated at $26,500,000, which represent a falling-off of about $4,000,000 over 1913. A million and a quarter of this loss is accounted for by the lower price of metals. Dividends of the mining companies of the Province have been $1,690,000 in 1914 as against $2,400,000 in 1913, and $465,000 more than in 1912. The Premier considers that taking the war into account this is a remarkable showing. The coal mines of the Island are now producing 6,750 tons per day which is 61 per cent. of the capacity.

The timber business has suffered from general trade depression as well as from the results of the war. However, a remarkable stimulus has been given to the pulp and paper business which the Government has been endeavoring for years past to develop. The mills at Powell River and Howe Sound have been flooded with orders from Aus-

tralia, New Zealand, South America, Japan and the Atlantic seaboard, the only unfavorable condition being the serious shortage of available shipping and the disturbances of freight rates caused by the war. The forest revenue for 1914 exceeded $2,000,000.

The last year was a banner one for fisheries. It saw the largest salmon pack for an "off-year" on record—1,100,000 cases. The total production of all kinds of fish was over $15,000,000.

Agricultural products worth $27,360,000 were grown in British Columbia last year, an increase of $3,185,000. In orchards, the area producing fruit has grown from 8,100 acres in 1900 to 38,200 to-day.

RUBBER EMBARGO LIFTED.

CONDITIONS under which Great Britain proposes to permit American manufacturers and dealers to import rubber from England and her Colonies were announced on Jan. 8 by the British Embassy at Washington. Guarantees with bonds in cases of large shipments will be required that the rubber will not be re-exported in any form to European countries except through the United Kingdom. Following is the Embassy statement:

"Arrangements have been practically completed whereby dealers and manufacturers in the United States can obtain supplies of rubber from the British Empire.

"Manufacturers wishing to obtain large shipments will be required to give a bond through their agent in London. In other cases shipments will be allowed to approved manufacturers and dealers who signify their willingness to sign appropriate guarantees. Shipments will be addressed to a bank in New York, who will not deliver rubber until purchaser has signed and deposited guarantee with his Majesty's Consul-General at New York, and he sanctions delivery.

"Manufacturers' guarantee will be an undertaking not to export any raw waste or reclaimed rubber except to United Kingdom or British Possessions."

NICKEL AND THE WAR.

THE world's production of nickel during recent years has been steadily increasing, as shown by the following figures in Engineering:—

	Tons	Tons Increase
1913	30,000	1,500
1912	28,500	4,000
1911	24,500	4,400
1910	20,100	.....

During the last six or seven years there has been a remarkable expansion in the industrial uses of metallic nickel. Two-thirds of the world's supply is produced in Canada; the remaining third comes from New Caledonia and is controlled by France. The Canadian nickel deposits differ from the German potash deposits in so far as the latter appear to have been no competing sources of supply; the former has no such monopoly. The Canadian contraband of war prohibition will act as an incentive to the opening out of new deposits and re-opening of old ones, several of which are situated in the United States, Greece, and other countries, all well known.

Norwegian Nickel Deposits.

Norway possesses extensive deposits of nickel ore, much of it containing as high as 2 per cent. of the metal. In former years nickel-mining was of some importance there, but competition with the richer ores of Canada and of some mines now shut down in the United States, could not be maintained, and most of the mines ceased operation. Towards the end of the last century the annual production of nickel sank to 7

EQUIPMENT FOR VICTORIAN RAILWAYS.

Tender forms and specifications have been received by the Department of Trade and Commerce, Ottawa, from Commissioner D. H. Ross, Melbourne, for equipment required by the Victorian Railways. Particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:—

28,108, February 17, 1915.—1 horizontal hollow chisel mortiser with chisels, tools and accessories.

28,119, February 17, 1915.—5,000 carbons for arc lamps.

27,846, February 24, 1915.—1-12½-inch gap lathe and accessories.

27,847, February 24, 1915.—1 single head pipe screwing machine including tools, gears and accessories.

27,848, February 24, 1915.—1 car journal burnishing machine, etc.

27,849, February 24, 1915.—1-5 cwt. pneumatic hammer and accessories.

27,850, February 24, 1915.—1-5 feet high speed motor driven radial drilling machine and accessories.

27,851, February 24, 1915.—1 double wheel lathe, including tools, gears and accessories.

27,852, February 24, 1915.—1 horizontal milling machine and accessories.

27,853, February 24, 1915.—1 double ended punching and shearing machine and accessories.

27,854, February 24, 1915.—2 pneumatic hand riveting hammers and accessories.

27,855, February 24, 1915.—1 pneumatic drill (Thor Class E).
1 pneumatic drill (Little Giant No. 3) including tools and accessories.

27,856, February 24, 1915.—1 grindstone, including tools, gears and accessories.

27,857, February 24, 1915.—1 shaping machine (single head) and accessories.

27,858, February 24, 1915.—1-2-inch single head bolt screwing machine, and accessories.

27,859, February 24, 1915.—1 self-acting power hack sawing machine including tools, gears and accessories.

27,860, February 24, 1915.—1 duplex boring and turning machine and accessories.

27,861, February 24, 1915.—1 8½-inch gap lathe, including tools, gears and accessories.

27,862, February 24, 1915.—2 wet tool grinding machines and accessories.

27,863, February 24, 1915.—1 twist drill grinder (wet), including tools, gears and accessories.

27,864, February 24, 1915.—2 upright drilling machines and accessories.

27,865, February 24, 1915.—1-16-inch lever feed high speed vertical drill, and accessories.

27,866, February 24, 1915.—2 air compressors, complete, with tools and accessories, and spares.

27,867, February 24, 1915.—1-8½-inch brass finisher's lathe, with accessories.

27,868, February 24, 1915.—2 pneumatic hand draft power moulding machines, and accessories.

27,869, February 24, 1915.—1 magnetic cleaning machine (for brass or other metal turnings), and accessories.

The last available mail from Canada is that leaving Vancouver on January 19 and due at Melbourne on February 14.

tons. It is now stated that the mines have been reopened.

On a small scale the Norwegian nickel ore-mining industry was revived some years ago, with an annual output of 70 to 100 tons, nearly all of which is used within the kingdom; one mine was worked at Eije with an ore output of 5,770 tons, producing 58.27 tons of nickel. In the smelting works 2.77 tons of matte is obtained from 100 tons of ore, and this contains 40 per cent. of nickel and 25 per cent. of copper. It is refined in the electrolytic works at Christiansand, which are equipped for an annual production of over 400 tons of the metal. The production of electrolytic nickel is a much more complicated operation than are those yielding aluminium or sodium. The electrolytic nickel has a high degree of purity, and is fairly compact. The total consumption of electricity is relatively large, and the process can be employed with advantage only where the cost of the current is exceptionally low, as is the case in Norway.

U S. Nickel Deposits.

The United States may be considered a non-producer of nickel, although a very limited recovery of this metal is made as a by-product in the electrolytic refining of copper. The States depend practically entirely on the nickel-ore mines of Sudbury, Ont., for their supplies of the metal. The production of the Sudbury mines during 1913 reached 750,000 tons of ore, most of which was smelted to matte containing about 24,000 tons of nickel. In 1912 the production of these mines amounted to 737.320 tons of ore, whilst the matte produced 22.421 tons of nickel. There are several important companies associated with this industry: —The International Nickel Company, the Mond Nickel Company; the British-American Nickel Company was engaged also early last year. The New Caledonian mines output of ore in 1913 was 75,300 tons, and 6,000 tons of matte.

Canadian Deposits.

The Canadian output during the last three years has been as follows:—

	Lb.	Tons.	£
1913	49 676.722	22.177	3.104.800
1912	44.841.542	20.018	2.802.600
1911	34,098.744	15,222	2,132,171

The Ontario deposits occur in a saucer-like arrangement of rocks of volcanic character. 35 miles across one way and 15 miles the other. The mines are grouped along the outer edge of the saucer, most of them near Sudbury on the south-east side. The central portion of the saucer is filled in with non-metallic rocks, in this case sandstones and slates. It was stated about fifteen months ago that nickel properties near Sudbury were sold to French capitalists for £1,875,000, but that a very large outlay of capital would be necessary to obtain an output. It is believed that the International Nickel Co. has spent approximately £2,-083,000 in the development of its Sudbury mines.

For the purpose of obtaining the nickel output given above, it was necessary to mine and treat 823.403 tons of nickel-copper ore during 1913 and 725,-065 tons during 1912. The companies turning out these ore are the Mond Nickel Co., the Canadian Copper Co., also owning smelters, and the Dominion Nickel Co. The quantity of Bessemer nickel-copper matte shipped out of Canada in 1913 was 47,150 tons, as compared with 41.925 tons during 1912. This matte carries small gold and silver values, as well as metals of the platinum group.

Considerable changes have been made in some of the details of smelting practice, although the general method remains the same—that is, the ore is roasted, smelted, and converted to a Bessemer matte, containing from 77 to 82 per cent. of the combined metals, copper and nickel, the matte being shipped to Great Britain and the United States for refining. The quantity coming to the former is, however extremely limited. Britain imported nickel oxide from the United States in the following small quantities:

	Cwt.	£
1913	17.965	90.120
1912	23.679	116.975
1911	15.117	74.310
1910	17.294	86.135
1909	19,455	96.325

A portion of the matte made by the Canadian Copper Company is used for the direct production of monel metal, an alloy of nickel and copper, without the intermediate refining of either metal. Of the metallic output of Canada, nickel is second in quantity and third in value, as shown below:—

		£
Nickel	49.676.770 lb.	3.104.800
Copper	76 975.830 lb.	2 448.600
Silver	31.750 618 oz.	3 955.000
Gold	784.525 oz.	3 378.300
Lead	37.662.700 lb.	365.500

The Province of Ontario has the largest mineral production. 40.75 per cent.; British Columbia coming next with nearly 20 per cent., and Nova Scotia third with 13.40 per cent. The output of the other six provinces is very limited, in no case reaching 10 per cent.

The Canada Producer and Gas Engine Co., Barrie, Ont., received an order for fifty 50-h.p. 3-cylinder gasoline engines for motor tractors for a firm in Plessisville, Que.

NEW BRUNSWICK DEAL TRADE.

THE shipments of deals, etc., from St. John to trans-Atlantic ports in 1914 were larger than in either of the two preceding years, but from the province generally the shipments were smaller than for several years past. There were no trans-Atlantic shipments from Richibucto, outports of Sackville, or Albert, or Bathurst, as in 1913, did not send any cargoes across the ocean. Considering conditions in the last five months, however, the business done must be considered reasonably good. The following is a statement of the shipments from St. John for 1913 and 1914:

Total, 1913	86,538,622
Total, 1914	91,679,007

A recapitulation of the shipments from the various provincial ports gives the following total for the year, compared with three previous years:

Year.	Deals, etc. Sup. feet.
1911	285,981,379
1912	245,806,682
1913	270,963,621
1914	217,906,813

Good prices prevail in the British markets, and although freights are high, lumber dealers are likely to do well.

OWEN SOUND, ONT.

BUSINESS activity in the city of Owen Sound is being well maintained during these times of general depression, the factories nearly all operating on full time. Government work is proceeding normally and considerable residence and business building is being done.

The Wm. Kennedy & Sons Co. have built a large two-storey stone addition to their steel foundry. The city has begun the construction of permanent concrete roadways, four blocks having been completed this fall. This work will be continued in the spring as weather permits. The Taylor & Pringle Co. have under consideration a large addition to their pickle and vinegar factory.

Hydro-electric development is proceeding at Eugenia Falls and the Commission expect to have the transmission line and distribution system completed during the coming summer, which will provide abundance of electrical energy for all purposes. A street railway is also under consideration, and is expected to materialize as power becomes available.

The Dominion Government has spent large sums of money during the last year on concrete docks and harbor works. These are expected to be proceeded with on the opening of navigation in 1915. Quite a large number of new dwellings have been built during 1914 and there are very few vacant houses.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News

Engineering

Stratford, Ont.—It is reported here that the G. T. R. have received an order for 10,000 shell parts.

Stamford, Ont.—The township council are in the market for a 1½-ton hand-operated traveling crane.

Regina, Sask.—It is announced that the Coste-McAulay syndicate will resume operations in the spring on drilling for natural gas.

Berlin, Ont.—The Canadian Buffalo Forge Co. has secured an order for 5,000 eighteen-pound shells for the Russian Government. This will necessitate the adding of additional facilities, and three shifts of men will be necessary.

Cobourg, Ont.—A by-law authorizing the issue of debentures for the raising of $50,000 in aid of the Federal Steel & Foundry Co., Ltd., for the establishment of a manufactory of steel and iron products, forgings and castings has been carried by a vote of 572 to 90.

Municipal

Essex, Ont.—The council are considering the purchase of a steam pump and boiler.

Saanich, B.C.—The municipality are contemplating installing a waterworks system.

Hamilton, Ont.—An expenditure of $110,000 on waterworks improvements is contemplated. A by-law will be voted on.

Ottawa, Ont.—The City Council will call tenders in the near future for a supply of brass castings for the waterworks department.

Fredericton, N.B.—Chief H. C. Rutter of the fire department, has recommended the purchase of a motor combination chemical hose truck and a motor ladder truck.

Hespeler, Ont.—The citizens voted on a $35,000 by-law on Jan. 4, for waterworks. It was passed by a majority of 30.

Montreal, Que.—The city proposes to spend $3,934,966.21 this year on new permanent paving, sidewalks, repairs to roads and sidewalks, street grading and on macadam.

Wheatley, Ont.—A by-law to grant Marvin White a 15-year franchise for supplying electric light and power to Wheatley was carried by the ratepayers by a majority of five.

Toronto, Ont.—Commissioner Harris has ordered three cars for the operation of the Bloor street car line. Hydro power for operation will be obtained from the station at Edwin avenue.

Toronto, Ont.—Quinlan & Robertson, the successful tenderers for the Bloor street viaduct, are making arrangements to start the work as soon as possible. Already considerable machinery to be used in construction has arrived.

Wallaceburg, Ont.—A by-law authorizing the town council to borrow $9,000 was carried on Jan. 5. The money is for the purpose of carrying on the Hydro-electric and waterworks system now being installed in Wallaceburg.

Montreal, Que.—Preliminary work for the foundations of the new St. Antoine market will be undertaken this spring. The new building will cost between $100,000 and $125,000. It will be fitted up in the most modern manner, and will contain a special refrigerating apparatus. Mr. Lacasse is the city architect, and J. E. A. Biron is superintendent of civic markets.

Montreal, Que.—The city will endeavor to borrow $5,800,000 for public improvements during the present year, according to an announcement made by Mayor Martin recently. On its increased valuation for 1914, the city can borrow over $3,000,000, while special loans which have been authorized for underground conduits, the aqueduct and other big undertakings will make up the balance of the six millions which the Mayor says will be sought.

Montreal, Que.—A special committee of the city council, which was appointed to enquire into the matter, have decided to recommend to Council the voting of $1,500 to complete plans for the construction of a tunnel under the Lachine Canal for the relief of traffic congestion. G. R. McLeod, the city engineer in charge of railways and bridges, in collaboration with a tunnel expert yet to be appointed, will prepare plans for the tunnel, which will be built under the canal at a point which is to be decided by the two engineers. It is suggested that Lt.-Col. H. R. Lordly be appointed to co-operate with Mr. McLeod.

Electrical

Brockville, Ont.—A member of the staff of the Hydro-Electric Power Commission of Ontario was recently in Brockville consulting with the management of the Light and Power Department relative to serving the rural district west of Brockville with electrical energy. It is proposed to include in the area several Summer Resorts located along the river for a distance of seven miles. The line will be constructed by the Hydro Commission and the power supplied by the local plant. Many large farms in the district have promised to become consumers and the project is being very favorably received.

General Industrial

Kincardine, Ont.—A by-law will probably be submitted to authorize a loan to the Mitchell woolen mill.

Valleyfield, Que.—The by-law to grant an additional bonus to Berman Bros. & Co., to establish a clothing factory has been approved by a majority of 37 votes.

Toronto, Ont.—Thomas Brothers have leased for a term of five years the ground and main floors of their new building on John Street, comprising 16,800 square feet, to the Automatic Box Co., for $20,000, or at the rate of $4,000 a year.

Tilbury, Ont.—Manager Odette, of the Canadian Top Co., has closed a number of large contracts with some of the leading automobile concerns, and he says the factory here will be running full time about the middle of this month.

Chatham, Ont.—It is reported that the Chatham plant of the International Harvester Co., is to be sold to the Massey-Harris Co. This may indicate a plan by the Harvester Company to give up Canadian manufacture, leaving the field open to Dominion concerns.

Moose Jaw, Sask.—The announcement was made last Thursday that a reorganization was in progress of the Moose Jaw Flour Mills, Ltd., and that the mill, which has been standing in a partially completed state for the past eighteen months, will be in operation in the course of the next few months. The mill was launched as a 3,000-barrel concern in 1912 by local men, but financial

difficulties have stood in the way, and the building, while complete, has been without machinery. New blood has been interested in the company, and a successful completion of the project is expected.

Windsor, Ont.—The Canadian Canners have purchased the Morand Canning factory at Tecumseh, and are asking the township of Sandwich East, for exemption from taxation. The same company is said to have purchased the McGregor factory.

Tenders

Calgary, Alta.—Tenders will be received up to February 12, 1915, for the furnishing and erecting of steel superstructure for Louise Bridge at 9th St. West. Plans, specifications and information may be obtained from the city engineer's office, upon making a deposit of $5.

Toronto, Ont.—Tenders will be received at this department until Monday, February 1, 1915, for the electric fixtures required for new Government House, Rosedale, Toronto. Plans and specifications can be seen at this department. H. F. MacNaughten, secretary, Public Works Department.

Winnipeg, Man.—Tenders will be received up to January 20, 1915, for the supply of gravel pit excavation, screening, elevating and crushing machinery; also for locomotives and cars for pit and for railway service. Specifications and form of tender may be obtained at the offices of the district. S. H. Reynolds, chairman of Commissioners.

Toronto, Ont.—Tenders will be received up to Tuesday, Feb. 2, 1915, for the supply and delivery to the Street Cleaning Department of 100 (more or less) loose paper can receptacles, as may be required. Specifications may be seen and form of tender obtained, together with all information relative thereto, at the office of the Street Cleaning Department, City Hall, Toronto.

Toronto, Ont.—Tenders will be received by the Chairman of the Board of Control, up to Tuesday, February 16, 1915, for supply and installation of furnaces and appurtenances for refuse incinerating plant. Specifications and tender form for the foregoing may be obtained upon application at the office of the Street Commissioner, Department of Street Cleaning, City Hall, Toronto.

New Hamburg, Ont.—Tenders will be received up to Wednesday, January 20, 1915, for the purchase of the real and personal property of the New Hamburg Manufacturing Co., Ltd. The plant is adapted for the manufacture of threshing machines, engines, cement mixers, etc. Full detailed particulars may be had on application to Charles J. Fox, New Hamburg, and Bissett & Peine, 24 Adelaide Street East, Toronto.

Contracts Awarded

St. John, N.B.—H. Horton & Sons have received an order for 600 sets of saddles and equipment from the Russian Government.

The Hamilton Bridge Works, Hamilton, Ont., have been awarded the contract for the steel work in connection with the Don section of the Bloor street viaduct, Toronto, at $400,000.

Chatham, Ont.—At the meeting of the council, the tender of the Canadian General Electric Co. was accepted for transformers for the sub-station, the order aggregating about $20,000.

Berlin, Ont.—The L. McBrine Co. of this city has received an order from the Russian Government for 1,300 saddles at $72.50 each. Leather for the saddles will be furnished by the Lang Tanning Co., of this city.

Winnipeg, Man—Contracts have been awarded in connection with the municipal hospital to the Canadian Fairbanks-Morse Co. for a motor-driven pump, motor and forced draft fan; to the Crane Ordway Co. for traps and receivers; and to the Western Steel and Iron Co., Winnipeg, for shaking grates.

Toronto, Ont—The Board of Control has let the following contracts for valves and pipe: Drummond McCall & Co., three 24-in. valves at $240 each; Glenfield & Kennedy, seven 12-in. valves at $1,690; National Iron Works, Ltd., and Canadian Allis-Chalmers, Ltd., for a quantity of cast iron pipe 3 in. to 20 in.

Fredericton, N.B.—Hon. John Morrissy, Minister of Public Works, has awarded contracts for two bridges in Queen's County. The contract for rebuilding the Enniskillen Station bridge was awarded to W. R. Fawcett, of Temperance Vale, while the Merritt bridge will be rebuilt by Robert Forbes, of Gibson. The contract price in each case is in the vicinity of $3,000.

New Incorporations

The Sweatmeat Co. has been incorporated at Ottawa with a capital of $50,000, to manufacture candies, preserves, etc., at Peterborough, Ont. G. N. Gordon, of Peterborough, is acting for the company during organization.

The Ball Furniture Co. has been incorporated at Ottawa, Ont., with a capital of $125,000, to manufacture chairs and furniture of all kinds at Hanover, Ont. Incorporators—R. J. Ball, M. L. Ball and John Ball, all of Hanover, Ont.

Moyes Construction Co., Ltd., has been incorporated at Toronto, Ont., with a capital of $40,000, to carry on a general construction, contracting and building business at Toronto, Ont. Incorporators—R. J. Moyes, G. Stagg and F. Reeve, all of Toronto, Ont.

The Globe Electric Machine Co., Ltd., has been incorporated at Toronto, Ont., with a capital of $800,000, to carry on a general engineering and machinist business at Hamilton, Ont. Incorporators—M. Buskard, S. G. Buskard, and F. Lazier, all of Hamilton, Ont.

Eplett Mfg. Co. has been incorporated at Ottawa, Ont., with a capital of $100,000 to manufacture paints, oils, varnishes, etc., at the village of Cumberland, Ont. Incorporators—R. K. Eplett, W. Graham and S. Karr, all of Cumberland, Ont.

NAlbergras Oil & Gas Co. has been incorporated, with head office at Ottawa, Ont., and a capital of $2,500,000, to carry on the business of producing and refining petroleum and petroleum products. Incorporators—T. C. Keefer, C. O. Wood and J. S. Hollinsworth, all of Ottawa, Ont.

Manufacturing & Contracting Co. of Canada, Ltd., has been incorporated at Ottawa, Ont., with a capital of $150,000, to carry on a general contracting engineering and constructing business at Toronto, Ont. Incorporators—T. A. Rowan, J. E. Jones and Norman Sommerville, all of Toronto, Ont.

Building Notes

Toronto, Ont—A building permit was issued on Dec. 30 to the Wm. Wrigley Co. for the addition of two storeys to their factory on Carlaw avenue, at a cost of $65,000.

Calgary, Alta.—R. B. Bennett, K.C., M.P., states that the work on the new armory will be started in the early spring. The plans for the building were now being prepared, and as soon as they are finished tenders will be asked on construction.

Toronto, Ont.—The permit for the erection of the new Provincial Hydro Power Commission's head office building on University avenue was granted by the city architect on Jan. 7. The structure will be six storeys high, and will be erected just north of the Alexandra Apartments. It will cost $75,000.

Railways-Bridges

Ottawa, Ont.—Application for time extensions will be made to Parliament next session by the Canadian Western Railway Co. and the Calgary and Fernie Railway Co.

Ottawa, Ont.—The Athabasca, Grand Prairie and Peace River Railway Co. will apply to Parliament at its next session for an Act authorizing the company to construct and operate certain lines of railway.

Trenton, Ont.—Fire on Jan. 4, destroyed the old roundhouse of the C. N. R. in North Trenton. Considerable additional loss was sustained in the equipment of the shop, together with the destruction of an official car and a gas-electric passenger car. The actual damage is estimated at $100,000.

Edmonton, Alta.—Engineers representing the Government and the Alberta and Great Waterways railway are now going over the proposed route of the road north of Mile 174, and it is expected that plans for the final link of the line will be tendered to the Government within a few weeks.

Dunnville, Ont.—Jas. P. Dunne, of the Ordnance Branch of the Department of the Interior, Ottawa, has concluded negotiations for the transfer of the Naval Reserve Lands on the east side of the river at Port Maitland to the T. H. & B. Railway. The land is to be used for development purposes in connection with the T. H. & B. Railway.

G. T. R. Cut Wages.—Over 14,000 employees of the Grand Trunk have been notified by Howard G. Kelley, first vice-president of the road, that on account of the falling-off in business, owing to the war, they will be asked to accept a reduction in wages, dating from April 1 next. Thousands of employees on the Grand Trunk Pacific have likewise been informed by Morley Donaldson, the general manager, that they will receive a cut in pay dating from the first of this year. In both cases the reduction is to be based on the results of operation for the half-year ending December 31 last.

Refrigeration

Toronto, Ont.—To further reduce the cost of maintenance at the hospitals and asylums in the province, a large abattoir will be erected on the prison farm at Guelph to take care of the meat supply required by a population of about eight thousand persons. Although the plans of the abattoir have not been completed, ground has been broken and the main lines determined. The cost of the new building will be something less than $40,000 and will have a capacity of two thousand cattle and a similar number of hogs annually.

Wood-Working

Hillsboro, N.B.—The plant of the Hillsboro Woodworking Co. was destroyed by fire on December 29. The loss is estimated at $7,000, with no insurance.

Montreal, Que.—Gingras & David's sash and door factory at Bordeaux, near here, was totally destroyed by fire on January 9. Damage estimated at $50,000 was done.

Halifax, N.S.—There is a proposition under way to establish a lumber and planing mill on the Tremaine property at the North-West Arm. Charles T. T. Piercy and W. D. Cranston are interested in the scheme.

Marine

Windsor, Ont.—Three veterans of the lakes, in the persons of Captain James Carney, Chief Engineer Alexander McDonald and Engineer Robert Craig, have retired and joined the superannuated list after serving the C.P.R. since the car ferry Ontario was placed in commission 25 years ago.

C. P. R. Discontinues Ferry at Windsor.—Independent operation of car ferries across the Detroit river between Detroit and Windsor will be discontinued by the C. P. R. on January 10. Under a new arrangement the car ferries Ontario, owned by the C. P. R., and the Pere Marquette No. 14, owned by the Pere Marquette Railroad, on and after January 10 will be operated under the joint control of the two railroads for both passenger and freight trains of each line, except the two fast passenger trains of the Canadian Pacific, running between Montreal and Chicago.

Charts of Inland Waters.—The Naval Service Department, Ottawa, will shortly publish a complete Canadian issue of charts of the inland waters of the Dominion. A series of forty plates representing the result of several years of work already done, have been received from the Imperial authorities. The work of surveying the Great Lakes has hitherto been to a great extent done by the British Admiralty but, with the assistance of the results of its labors, the Canadian Government will now bring it much more nearly up to date. Two survey ships, La Canadienne, on Lake Superior, and the Bayfield, on Lake Ontario, are now engaged in surveying. Lake Ontario has been practically completed, and good progress has been made with the work on Lake Superior and Lake Huron.

Ottawa, Ont.—It is the intention of the Department of Marine to establish a uniform system of characteristic for gas-lighted buoys and gas beacons, making buoy or beacon lights that are to be left on the starboard side in going up stream occulting red lights, and port hand lights occulting white lights—that is, red buoys will carry red lights, and black buoys white lights. For special positions, such as middle grounds, and fairways, special arrangements will be made. White lights will, however, be favored when possible. It is proposed to make the changes on the opening of navigation or by May 1 next.

Lakes Protective Association.—The Lakes Protective Association made a very good showing in 1914, which means underwriters had a profitable season, as the association carries 25 per cent. of the insurance on the bulk of the freighters that are insured. Not one of the 19 vessels lost last season was enrolled in the Protective Association, members of which operate about 200 vessels. Only one boat in a hundred was in an accident in which there was a total loss. The steamer Caldera sank the steamer W. H. Gilbert in Lake Huron. The heaviest loss to the underwriters was the steamer Benjamin Noble, which was insured for about $120,000. Her cargo of steel rails was also insured.

Personal

Herbert Samuel Holt, president of the Montreal Light, Heat & Power Co., Montreal, has been made a Knight Bachelor.

William Hurst, manager of the Hurst Engineering & Construction Co., Winnipeg, Man., has returned home after a short vacation at Galt, Ont.

George Joseph Desbarats, Deputy Minister and Comptroller of Naval Service, and formerly Deputy Minister of Marine and Fisheries, has been made a C.M.G.

Harry Bayne has been appointed General Agent for Canada and Newfoundland for the Safety Car Heating & Lighting Co., of New York, with offices in Montreal and Toronto.

Arthur Hatton has been appointed general superintendent of the C.P.R. car service, with headquarters at Montreal, to succeed George S. Cantlie, Lieut.-Col. commanding the 43rd Royal Highlanders in the third Canadian contingent for overseas service. Mr. Hatton began his connection with the C.P.R. as a telegraph

operator 23 years ago, and has been associated with the company's car service in Winnipeg.

C. O. Stillman, president of the Imperial Oil Co., Sarnia, Ont., has left for a trip to Peru, where he has business to transact over some new oil property belonging to the company.

H. M. Ford, recently at the Montreal office of the B. F. Sturtevant Co., Ltd., of Canada, has started in business for himself at 802 New Birks Building, Montreal,, and is handling Sturtevant Vacuum Cleaners.

G. H. Howard, who has been traveling for the A. R. Williams Machinery Co. for the past seven or eight years, has severed his connection with them to take a position on the sales staff of the John Bertram & Sons, Co. Mr. Howard will represent both the Bertram Co., and their associate the Pratt & Whitney Co., of Canada, Ltd., in the Niagara District and Western Ontario, with head quarters at Dundas.

J. E. Rogers, who for the past seven months has held the position of second vice-president and assistant general manager of the Russell Motor Car Co., West Toronto, has resigned to accept the position of general manager of the International Time Recording Co., with factories and head offices at Endicott, N.Y. Mr. Rogers was formerly assistant general sales manager of the National Cash Register Co., and joined the Russell staff in May last.

G. A. Irwin has been appointed sales manager for the Algoma Steel Corporation, and assumed his new duties at the first of the year. He has been connected with Drummond McCall & Co. for the past thirteen years, which firm have been acting as sales agents for the Algoma Steel Corporation. Mr. Irwin had charge of the sales of all the products of the Algoma Steel Corporation, and in addition had charge of the sales of iron ore and pig iron. About July 1 last year the Algoma Steel Corporation decided to sell direct, hence the opening of the Montreal sales office of which Mr. Irwin is in charge, in the McGill Building.

Thomas Coltrin Keefer, C.E., C.M.G., LL.D, one of Canada's most noted engineers, died at his home in Ottawa on Jan. 7. Mr. Keefer was born at Thorold, Ont., in 1821, and began his engineering career in 1836. He conducted the original surveys for the G.T.R. in 1851, and later was a strong advocate for the construction of the C.P.R. In addition to his work on railway construction, Mr. Keefer was an authority on harbors and waterworks, and was during his long career connected with many important undertakings.

Trade Gossip

The Bawden Machine Co., Toronto, has been awarded a contract for hydrants and stop valves by the Toronto Board of Control.

F. H. Hopkins & Co., Montreal, dealers in railway and contractors' supplies, have opened an office in Winnipeg at 1206 Union Trust Building, in charge of J. W. Purcell.

The Herbert Morris Crane & Hoist Co., Toronto, have been awarded a contract for an ash hoist for the Williamson Road School by the Board of Education, Toronto.

Orders for Algoma Steel.—It is reported that the Algoma Steel Co. of Sault Ste. Marie, Ont., has taken orders for 15,000 tons of rail for the United States at a price lower than the market level there.

Joseph Bowler and H F. Bowler have entered action at Osgoode Hall against the Toronto Structural Steel Co., Limited, for $5.000 damages for alleged negligence causing the death of John Bowler who was killed on a collapsing scaffold at Streetsville O,nt.

The Green Fuel Economizer Co. has entered action at Osgoode Hall against the city of Toronto to recover $5.917.25 alleged due for an economizer said to have been wrongfully destroyed by the city and valued at $4,000, and $1,370 with $547.25 interest for installing a draft fan at the city pumping station.

Wagon Works Busy—The employees of the Petrolia Wagon Factory started working full time last week. An order for nearly a hundred large military wagons is well under way and this has been supplemented by an order from many of the farm wagon dealers throughout Ontario.

U. S. Exports of Copper.—Copper exports from the United States through the principal Customs district during the week which ended December 26, amounted to 2.841,570 pounds, valued at $372,073, and for the four weeks 33,565,937 pounds, valued at $4,197,547. During the December 26 week, 1,151,581 pounds were exported to England, and 1,569,107 to Sweden.

Orders Placed for Saddles.—The Canadian Government Sub-committee which has been looking after the purchase of supplies in Canada for the allies has placed the order received recently from the Russian Government for twenty thousand saddles. The contract which totals up to $1,500,000 has been distributed among manufacturers of saddlery in all parts of Canada.

More War Orders.—Secretary Griffiths, of the High Commissioner's office, in London, has stated that on one line alone of war necessities, Canadian manufacturers may hope to receive orders from the British Government which will spread over the next six months, and will approximate in value twenty-five million dollars.

Companies Formed in 1914.—During the twelve months of the past calendar year, 3,500 new companies secured Dominion or Provincial charters, according to The Monetary Times Annual. The total authorized capitalization of these companies was $893,249,605. The largest number of companies was chartered during the week ended August 7, when 180 Federal and Provincial charters were granted. The largest aggregate authorized capitalization for one week was that for the week ended August 14, when the figures were $79,406,975. No less than 675 companies were incorporated in connection with the Calgary oil fields last year. They had an aggregate authorized capitalization of $351,730,000. Of these companies, 166 had authorized capital of $1,000,000 or over.

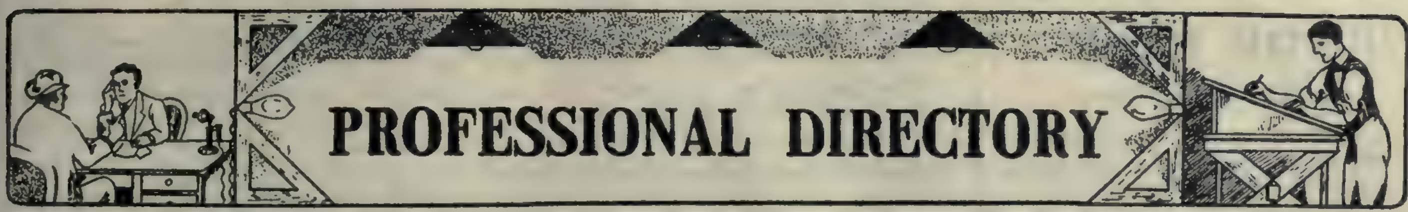
Dominion Steel December Output.—The business of the Dominion Steel Corporation in the closing months of the year did not show great improvement. The output for December, 1914, as compared with the previous year in all departments is as follows:

	Dec., 1914. (Tons)	Dec., 1913. (Tons)
Pig iron	12,843	20,535
Steel ingots	19,787	19,082
Rails	3,700	10,411
Wire rods	3,762	1,484
Bars	410	265
Wire and wire products	2,567	1,556
Coal mined	317,003	396,824
Steel Shipments	12,048	5,549
Coal	221,597	261,316

Catalogues

Grinnell Sprinkler. — The January number of the Grinnell automatic sprinkler bulletin has been issued by the General Fire Extinguisher Co., Providence, R.I. The principal feature in this number is a series of views of the Edison Co. plant taken after the recent disastrous fire. The reading matter deals with the value of having a Grinnell sprinkler installation as an effective method for the prevention of fires.

Steam Boilers and Boiler Feed Water is the title of an attractive little booklet which we have received from the American Steam Gauge & Valve Mfg. Co., Boston, Mass. It consists of a short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treatise on the scientific management of boilers, published by the American Boiler Life Co., Borston, Mass, and explains the principal features of the company's boiler preservative and the chemical combination involved. The booklet also deals with the question of boiler scale, its formation and elimination.

Cranes and Hoists.—The Northern Crane Works, Ltd., Walkerville, Ont., is distributing a 32-page booklet descriptive of their electric traveling cranes and hoists. The purpose of the booklet is to illustrate a few of the principal types, some being shown in operation. Complete specifications and other particulars are given in separate bulletins, which can be obtained on application. Other products illustrated include handpower cranes, jib cranes, gantries, electric hoists, etc.

Water Softeners.—The "Cochrane" Engineering Leaflet, No. 17, describes the Sorge-Cochrane Hot Process System for Softening Water. The leaflet, consisting of 20 pages, contains much useful information on preparation of water for steam boilers, impurities in water and their elimination, and the chemistry of water softening. A complete description is given of the Sorge-Cochrane process and the apparatus employed in connection with it, while interior views of the apparatus show clearly the general construction. The leaflet can be obtained from the Canadian Allis-Chalmers, Ltd., Toronto, Ont., who are the Canadian agents.

Feed Water Regulators, made by the Elliott Co., Pittsburg, Pa., are described in Bulletin No. 1, recently issued. The benefits to be derived from the use of fed water regulators are first dealt with, followed by chapters on water columns and controlling valves. The various types of feed water regulators are then described, accompanied by a dimension table and price list for each. The descriptions of the various apparatus are very complete, while with the illustrations are included sectional views showing the general construction. The bulletin concludes with a series of diagrams showing a number of typical feed water regulator installations.

Dixon Crucible Booklet.—In a new edition of the booklet "Dixon's Graphite Crucibles," information is furnished concerning steel melting crucibles, file crucibles, crucible covers, tilting furnace crucibles, retorts, bottom-pour crucibles, stirrers, skimmers, dippers and self-skimming crucibles. Some good advice is given in two pages relating to oil furnaces and general hints. Foundry facings and a highly refractory cement for the repair of worn or cracked firebrick are also described. This little booklet is altogether worth while to the man interested in the subject of better foundry practice, and a copy is gratis to those who take the trouble of writing the Joseph Dixon Crucible Co., Jersey City, New Jersey.

J.-M. Sea Rings.—The Blue Book of Facts and Figures issued by the Canadian H. W. Johns-Manville Co., Toronto, deals very thoroughly with the J.-M. Sea Rings, which are also referred to as the Ideal automatic packing. The catalogue states how this packing is made, the purposes for which it can be used, and the reasons why the different materials are employed. One illustration is of especial interest, as it shows a number of dimensioned sections with the view to drawing the reader's attention to the precision and accuracy employed in the manufacture of the packing. Other products described are the J.-M. Permanite sheet packing and flange gaskets. All the products are illustrated and views are included of the company's plants and offices.

Book Reviews

The Mechanical World Pocket Book and Year Book for 1915, published by Emmott & Co., 65 King Street, Manchester, England. Price, 25 cents post paid. This is the twenty-eighth issue of the well-known "Mechanical World" pocket book for engineers and draftsmen. This publication gets larger and better each year, and contains a great deal of valuable information at a small cost. In this issue many new features have been introduced. The section on toothed gearing has been re-written and considerably extended, and includes some useful notes on gear cutting. More matter has been introduced dealing with structural iron and steel work. The section on the gas engine has been revised and extended, while a new section has been added dealing with limit gauges. New tables are included on the cost of power, helix angles, morse tapers, etc., and many additional illustrations have been introduced. In addition to the technical matter, 52 pages are devoted to a diary. The book is pocket size and bound in substantial cloth covers.

Resuscitation from Mine Gases.—Technical paper, No. 77, is used by the Bureau of Mines, Department of the Interior, Washington, D.C., embraces a report of the committee on Resuscitation from Mine Gases. The purpose of the investigation was to develop an efficient method of resuscitation, which may be administered by miners or other persons who have not had the training of a skilled physician, but frequently have to treat a fellow-workman

Compressed Air and Its Mechanical Production Features*

By E. T. Spidy **

The service scope of compressed air is, we might say, almost limitless, and its convenience has become so commonplace as to tend to make us neglect to familiarize ourselves with the mechanisms of its production. The author of this paper makes opportunity to get conversant with the latter by clear and easily intelligible featuring of the cardinal points.

COMPRESSED air is a safe form of power that can be adapted to man's needs where steam or electirc power is unsuitable. It is not a new power, its use dates back to the early Christian era from which time it has progressed slowly. Its present-day use in train operation as seen in the form of the modern aid-brake has revolutionized the world, and its use in our shop practices has also caused a small revolution in shop methods. I do not intend to go into and detail of the uses of compressed air, as this would be wasting time, but I have found, however, in my study of the subject, that it is necessary to delve rather deeply into the details of air conditions and changes in order to get an intelligent idea of the whys and wherefores of compressed air. For this reason, after briefly outlining the different types of machines employed to compress air, I will concentrate on the most common type of compressor to explain the effect of the elements as they are encountered. It must be remembered that this is done simply to illustrate the case, these effects having the same relation to smaller or different type machines in proportion to their capacity.

Compressor Types.

Air compressors may be divided into two general classes, namely, reciprocating machines and rotary machines. Reciprocating compressors may be either horizontal or vertical type, depending chiefly on the available floor space, and this type compress the air through the medium of one or more cylinders containing pistons that reciprocate back and forth discharging air compressed at each stroke. Rotary compressors or blowers discharge a continuous stream of air by means of centrifugal force developed by vanes on the rotor or rotating centre. This type delivers a steady volume up to a few pounds pressure, or else, as in some of the newer types, by other ingenious methods, with oval or irregular shaped casings and special shaped rotors which are designed to trap the air on the inlet side and crowd same out the discharge pipes, giving a positive flow at various pressures and volumes.

It is recognized at the present time that rotary machines are only economical operating at low pressures with large volume output, whereas no limit has been fixed, beyond the strength of the materials in the machines, for pressures attainable by reciprocating type compressors. While in railroad work we are concerned with both types, it is my intention to deal only with high-pressure machines.

Action of Air Compressors.

Air compressors whether single stage or multiple-stage type, all operate on the same principle. In a single-stage compressor, during the suction stroke air is drawn into the cylinder through valves that may be mechanically operated or they may open by the suction pressure alone. On the return stroke, the inlet valve is closed and the pressure of the enclosed air mounts until it exceeds the pressure behind the spring discharge valves; it is then discharged into the service line leading to the main reservoir. In two-stage compressors this action is repeated by introducing the air discharged from the first cylinder into a second cylinder. This second cylinder is smaller in diameter than the first because of the greater pressures involved, so as to equalize the amount of work done by each cylinder, and to balance the machine in order to keep it running smoothly; the air is discharged from it at the desired line pressure. Multi-stage compressors repeat this process in additional cylinders according to the designed economic output of the machine.

In order to fully understand the construction of air compressors and the trouble of maintaining a regular service, we require first of all to follow the course of the air through a machine in more detail, and to note the changes that take place at every stage. We shall then realize, after a study of these changes, that there is a definite cause for all the phenomena met with, and thereby we shall more clearly see how far the efforts of air compressor builders have been successful in producing the most perfect machine of this type.

For purposes of description we will take a two-stage compressor of modern design and describe in detail the action that takes place. It will be recalled from the foregoing that a two-stage compressor embraces all the features of the multi-stage type compressor and has additions to the single stage type which will be mentioned in due course.

During the past year the author has made a considerable number of tests on different compressors and the figures will be actual results from recent tests on one of the new 2350 cubic foot compressors recently installed at the Canadian Pacific Railway Shops, Winnipeg. Atmospheric air is drawn into the low-pressure cylinder, which is 28 inches in diameter, at the temperature of 65 degrees Fahrenheit, through positively operated inlet valves, and is compressed up to a pressure of 24 pounds per square inch. During compression the temperature of the air rises and upon discharge into the receiver pipe has attained a temperature of 200 degrees Fahrenheit, From this receiver pipe the air passes round a nest of cold pipes called the inter-cooler, its passage being diverted by baffle plates which assure the reduction of the temperature before it enters the second or high-pressure cylinder. The air actually enters the high-pressure cylinder, which is 17 inches in diameter, at a temperature of 80 degrees Fahrenheit. The air is then re-compressed in the high-pressure cylinder to a pressure of 100 pounds per square inch, and during this stage attains a temperature of 225 degrees Fahrenheit, at which temperature the air is discharged into the main reservoirs.

Isothermal and Adiabatic Compression.

It is to be particularly noted that the temperature of the air rises during compression. We do not need this heat, but it is quite impossible to avoid it. It is the result of the work or energy expended by the machine itself on the air, in changing its volume and raising its pressure. If it were possible to compress air without raising the temperature we should have an ideal condition and would have what is called Iso-thermal compression. Iso-thermal compression or expansion is explained in the first law of gases known as "Boyle's Law" which states that the "Volume of a gas decreases in the same ratio as the pressure on it increases, if the temperature remain constant." Since we know we have the temperature increase to deal with, let us note exactly how it affects the air during compression. The application of heat to any gas causes expansion to take place, and if heat is applied to a quantity of gas in an enclosed cylinder where expansion is restricted, then the result will be that

*From a recent paper before the Western Canada Railway Club.

**Assistant General Foreman, C.P.R. Shops, Winnipeg, Man.

an extra pressure must be generated in the cylinder.

Consider this action in a compressor and it will be seen that the rapidly increasing temperature causes an excess pressure to open the discharge valves a little earlier than they would if the heat were not present. In the intercooler, this heat is removed causing the loss of this excess pressure. In the high-pressure cylinder, the temperature generated again causes the discharge valves to open sooner than required and later when the heat is dissipated in the reservoir and service lines this effect is lost again. Compressing air and not removing any of the heat generated is called Adiabatic compression and this is illustrated in what might be called the second law of gases known as "Law of Charles," which reads: "That the volume of a gas at constant pressure is proportional to its absolute temperature." From this law we see that the temperature increases at a definite rate and that we are able to plot a curve for any particular case which will show us when compared with actual indicator diagrams, how much we accomplish by cooling the air by the means employed.

The necessity of cooling the air during compression becomes apparent if what has been said regarding the effect of temperature in the cylinder has been understood. A single-stage compressor taking in air at atmospheric pressure at a temperature of 60 degrees Fahrenheit and compressing it to 25 pounds gauge pressure has a final temperature of 234 degrees Fahrenheit, and if compressed to 80 pounds gauge pressure the temperature reaches 432 degrees Fahrenheit; and at 100 pounds pressure its temperature is 485 degrees Fahrenheit. A two-stage compressor taking in atmospheric air at the same temperature develops the same number of heat units to reach 100 pounds pressure with this difference, that the final temperature of the air in each cylinder is only about one-half of that of the single-stage compressor cylinder.

Necessity of Cooling the Air During Compression

It is obvious that in order to lubricate the cylinders to keep them in working condition they must be cooled, and for this reason as well as for the slight cooling imparted to the air in the cylinder, all compressor cylinders are cold water jacketed. This is of more importance in the single-stage compressor cylinder on account of the higher range of temperature per cylinder, because as has been frequently the case, the lubricating oil is deposited as carbon on the piston and cylinder heads and the heat of the compression after vaporizing the oil passes its flash point and thereby causes explosions which are not at all infrequent. Early designers also realized this necessity and sprayed cold water into the cylinder during the compression stroke. Present-day methods make this method impracticable on account of the high speeds of the compressors and the amount of water that would be absorbed by the air during this process.

Compressing in Two or More Stages.

It has been shown that the effect of the heat generated in the cylinders is to increase the pressure in the cylinders or rather to cause the pressure to reach the discharge point before it would do so if the heat were not present. This excess time of discharge consumes power and it is the main object of compressing in two or more stages to reduce the extra power required to compress the air due to the heat effect. Actual test proves that to compress air in a two-stage machine requires from 12 per cent. to 18 per cent. less power than to obtain the same results in a single-stage machine. Multi-stage compressors show a greater saving, still dependent, of course, on the design.

Reheating the Air.

If it were possible to use the air immediately it left the machine, that is, before the heat of compression is lost in the pipe lines by radiation, etc., we should not require to bother with this troublesome element beyond the compressor itself, because its expansive effort could then be utilized in the motor or other engine driven. We should in that case by cooling the air be losing power. This advantage is made use of in small outfits, but with plants that have a network of reservoirs and pipes in which to maintain a pressure, it is impracticable because the reduction in temperature is bound to take place somewhere or other, and this reduction causes the moisture in the air to be precipitated. This moisture deposited shows itself in the form of water in a way we are all familiar with. The losses due to temperature, friction, etc., on long lines is considerable and the use of reheaters is extremely economical under special circumstances. Reheaters are used somewhat extensively in connection with the Popp system in Paris. This system supplies compressed air on an industrial basis similar to the way electric power is supplied here.

Professor Unwin says that 46 per cent. more energy may be obtained from the air by the use of a reheater, by the expenditure of a small quantity of fuel in a suitable heater. Air delivered to the reheater from a source, perhaps several miles away at a temperature of 59 degrees Fahrenheit is, after passing through the reheater, delivered to the machine at a temperature of 299 degrees Fehrenheit, which temperature closely approaches the useful limit of reheating air. These heaters consist either of a coil through which the air passes, the coil being placed in a coke or oil furnace, or else of a cast iron oven heated by a coke fire underneath along the lines of a hot air household furnace. It has been calculated that fuel spent reheating air in this manner turns six times the number of heat units into useful work that the best steam boilers and engines can obtain.

The temperature of the air as it enters the compressor plays two very important parts in practice. The first of these is that air always contains a certain percentage of moisture, and while the amount of moisture carried by the air does not affect the compressor itself, it sure does effect its successful use in our shop practices. Air readily absorbs moisture and the higher its temperature the more moisture it can contain. This is what we commonly call humidity. The percentage of humidity merely means the percentage of moisture the air does contain compared with the amount it can contain at any temperature. For this reason intake pipes should always draw air from the outside of the power building rather than from the inside, because the presence of free steam near the intake of the compressor greatly increases the amount of water to be deposited somewhere in the service.

Water in the Air.

The greater the air pressure the less moisture the air can hold in suspension. In practice this fact can be neglected because the amount of deposited moisture due to pressure is so slight compared with the temperature effect which increases the power of suspension at a very much greater rate. Moisture or water cannot be entirely eliminated from service lines, but much of it may be deposited by proper cooling devices. Moisture enters the compressor in the free air and passes into the inter-cooler where some of it is deposited by the sudden temperature drop there. In some machines this deposited water is drained off, but in others it passes with the air into the H. P. cylinder, and the heat of compression readily absorbs the same again, passing it most often direct to the reservoirs. If an after-cooler (this is a nest of cold tubes of exactly similar construction to the intercooler) be placed between the discharge pipe of the H. P. cylinder and the reservoir or service lines, the temperature of the air will be suddenly reduced to normal and most of the water will be deposited where it can be drained off easily. The idea is to ensure the reduction of the temperature

of the discharge air to normal before entering same into service pipes.

Another way is to connect at least three reservoirs in chain so that the air has to pass through all of them separately before entering the lines. This will collect the water very well, it being necessary to drain the reservoirs very frequently. By reason of the same law that the air heats upon compression, so upon expansion of the air, such as takes place at the point of operation, does the temperature drop in the same ratio. This accounts for the way our motors sometimes clog up with ice in cold weather when any amount of water is present. This principle is used to good advantage in certain classes of refrigeration machinery. Liquid air is also made by this process. The only way to avoid this trouble is to remove the water or warm up the machine.

Effect of Intake Temperature on Discharged Volume.

Apart from the moisture-carrying capacity of the air, the temperature of the intake air has a second and very important effect, and this is upon the volume of air discharged by the compressor. As we know already, heated air takes up more space than cooler air. It can be understood, then, that a cylinder full of heated air means a less amount of air than a cylinder full of cooler air, because it is thinned out, so to speak. In round figures, the gain in efficiency or the increase in actual output amounts to 1 per cent. for every 5 degrees lower the temperature of the intake air is than the temperature inside the power building. This is another very good reason for having the intake air drawn from the outside atmosphere.

Effect of Altitude.

Atmospheric pressure at sea level we know is 14.7 pounds per square inch. This pressure is caused by the weight of the air above, and for every 1000 feet ascent above the sea level there is approximately a decrease in atmospheric pressure of one-half pound per square inch. Conversely also in deep mines the pressure increases at the same ratio. Thus, in considering compressed air requirements, altitude of the location must be considered if the machine is to be placed at any sensible height above the sea level, such as for mountain service.

To illustrate the effect, let us take the two-stage compressor described and transplant it at a point 3,000 feet above the sea level. We should find that the density of the air at this altitude was only 90 per cent. of the density at sea level. This is to say that at the same working speed we should have suffered loss of 10 per cent. in volume delivered. To correct this we require to supply more power to raise the speed the necessary 10 per cent. in order to raise the capacity to what it should be. The air being thinner or less dense, the power required to compress one cubic foot of it is less than at sea level. Actually we should require 4.3 per cent. extra power in order to get the 10 per cent. extra speed.

Compressor Explosions.

Air compressor explosions are a comparatively rare occurrence but yet of such importance that the causes of explosions will stand to be better understood. To have an explosion we must have an explosixe mixture and a means of exploding the same. It is not difficult to find the source of the combustible, it being the lubricating oil in most cases, but it is more difficult to understand how it becomes ignited. Explosions are most always the result of oversight or neglect, which fault compressor builders cannot do a great deal to lessen the chances of happening by proper design. We can understand how the deposits of carbon reach the valves and passages especially if a grade of oil is used that has a flash point below 600 degrees Fehrenheit, but as often as not the explosions have taken place where lubricants have a flash point over 700 degrees Fahrenheit have been used. It is obvious that excess temperature must be developed and the following causes have all contributed to their share of damage:

If supply of cooling water for cylinder jackets and intercooler become shut off, the compressor will heat up very quickly, and when this happens the machine must be shut down immediately. With the cylinders becoming hot, the air during admission will be preheated and the final temperature in the cylinders is then much greater than it would otherwise be.

It is seen, then, that a heat building process is started which has no limit beyond the temperatures the materials of construction will withstand. It has happened with the carbon and oil deposit in a compressor with a rather small discharge pipe area, that the pipe area becomes so restricted with these deposits that the friction of the air increased the temperature beyond the flash point of the oil thus causing an explosion. This occurs because greater pressure is needed to force the oil through the passages and the extra temperature accompanies the extra pressure in direct ratio.

The greater source of danger is in discharge valves becoming coated with carbon deposit and becoming stuck in an open position. This allows hot compressed air to get back during the suction stroke due to the pressure already in the cylinder, the temperature rises away above normal and ignites any mixture that may be at hand.

Air compressors with inlet throttling devices to reduce the amount of discharged air when the full capacity of the machine is not being used need particular care to avoid carbon deposits because of the high temperature ratio developed when throttled down less than half capacity. This more particularly applies to constant speed compressors wherein speed regulation in connection with output is impracticable.

Failure to keep the intercooler free from scale or mud deposits on the water side of the pipes interferes seriously with the cooling efficiency of the intercooler, with the result that the air enters the high pressure cylinder at a higher initial temperature than it should. This not only impairs the volumetric efficiency of the compressor but also helps to form an explosive mixture.

Many explosions have occurred in air reservoirs also. Most often the cause has been traced and found to be that the reservoir at some time or other held

PUBLIC RIGHT.

The idea of public right when translated into concrete terms means first and foremost the clearing of the ground by the definite repudiation of militarism as the governing factor in the relation of States. It means next that room must be found and kept for the independent existence and the free development of the smaller nationalities each with a corporate consciousness of its own. They must be recognized as having exactly as good a title as their more powerful neighbors—more powerful in strength and in wealth—to a place in the sun. It means finally, or it ought to mean, perhaps by a slow and gradual process, the substitution for force, for the clash of competing ambition, for groupings and alliances and a precarious equipoise of a real national partnership based on the recognition of equal right, and established and enforced by a common will. A year ago that would have sounded like a Utopian idea. It is probably one that may not, or will not, be realized either to-day or to-morrow, but if and when this war is decided in favor of the Allies, it will at once come within the range and before long within the grasp of the world's statesmen.—H. H. Asquith.

oil. Under such circumstances, as shown, an explosive mixture has been made with disastrous results.

Compressor Efficiency

Owing to the somewhat complex nature of the happenings in an air compressor, the total measure of efficiency of any machine can only be determined by finding the measure of efficiency from three separate standpoints. These are Volumetric efficiency, Mechanical efficiency and Thermal efficiency.

The volumetric efficiency of a compressor is the ratio of the actual amount of air at atmospheric pressure and temperature, delivered compressed into the main reservoir, to the cylinder displacement. Cylinder displacement meaning the total space swept by the piston or pistons of single-stage compressors and only the low-pressure cylinder displacement in two or multi-stage compressors.

The mechanical or compression efficiency of a compressor is the measure of the energy in horse-power put into the machine for which a certain delivered amount of compressed air is obtained, compared with the theoretical horse-power required to compress that same quantity of air, when heat of compression is removed as quickly as it is generated.

The thermal-efficiency of a compressor is the ratio of temperature of the delivered air to the temperature of the intake air.

Briefly summarized the following are the causes of loss in compressor efficiency, and the remedy where possible:

1.—The clearance space between the piston and cylinder ends is a source of loss of volumetric efficiency, and for mechanical reasons it is not possible to do away with this clearance space. It is seen that this space must be filled at each stroke with atmospheric air which is compressed to discharge pressure at every stroke. This amount of air is never delivered, and is, in consequence, a loss in volume delivered, although not so much a mechanical loss by reason that this air gives back to the piston its stored energy because of its expansive power.

2.—Heating of intake air is a volumetric loss on account of the expansion due to heat absorbed, as explained earlier in this paper. We require to be careful that the passages of the intake air from the outside atmosphere to the suction valves are insulated from any heat such as from steam pipes or other hot surfaces under or over the power house floor.

3.—Wire-drawing, or in other words, friction of the air in intake passages, due to small passage area, is a volumetric loss because the cylinder will not be completely filled with air on the suction strokes. If we do not completely fill the cylinders with free air it is obvious we cannot compress it.

4.—Leakage of air through valves or past the piston is a large source of volumetric loss by reason that any air that leaks past is in a heated condition due to the effect of previous compression. Not only is this a loss from the side it has left, but it causes a loss where it arrives by increasing the temperature ratio giving the effect of heated intake air.

5.—Pressure required to overcome the resistance of air in discharge passages is a mechanical loss because no increase in amount of air delivered is done by this work. Passages require to be kept free from deposits to facilitate the moving of the air otherwise friction will become excessive.

6.—Heat of compression causes both mechanical and thermal loss by reason that the temperature develops excessive pressure in the cylinders which is afterwards lost upon the cooling of the air. Good water jacketing of cylinder and heads and clean intercoolers insure the best results in this connection.

7.—Upkeep of compressor mechanism is important because inaccuracy of action of valves, etc., causes not only mechanical loss but volumetric and thermal losses as well.

Indicator Diagrams.

The question that most probably arises at this point is: How are we going to watch all these points since there is so much detail to be taken care of? I would answer, "Indicate your air compressors regularly." The value of indicator diagrams on steam cylinders is well recognized, and as air compressor cylinders are practically identical with steam cylinders with only valve modifications, the value of diagrams from air cylinders is unquestionable. Diagrams from two-stage and multi-stage compressors require to be compounded to show relative value of heat and energy expended in each cylinder. By placing theoretical compression curves with and without heat effect on a diagram it can be seen at a glance where the losses are to be found. The engineer in charge may notice many defects but there are as many he cannot see because they do not affect the gauges on the machines.

Regularly-taken diagrams save the repair bill or shut-down by reason of the advance information given which enables preparation to be made for coming trouble. The advantage is thus two-fold because not only is the defect and cause ascertained quickly from the diagram, but also power computations are as easily made. When once this system of inspection is started and understood, I am fully convinced it would not be dropped because the results will far more than justify the trouble of obtaining this information.

CANADA LEADING IN WATER POWER DEVELOPMENT.

THAT Canada is at present utilizing more electric power per capita than any country in the world was the remarkable fact brought out a recent meeting of the Canadian Society of Civil Engineers at Montreal. It was shown that not only is infinitely more power per head developed here than in any European country, but that we lead the United States three times over in this development. The electrical power developed in Canada amounts to one horse-power per year for each eight people, as against one per 24 in the United States, and one per 100 for Europe generally. It was, however, pointed out that this was apt to be misleading, as Europe included such countries as Turkey, Russia and the Balkan States, where electrical development was practically unknown.

The foregoing information was elicited from a paper read by A. Surveyer on "How to Make Water Power More Valuable." In his paper, Mr. Surveyer pointed out that there were known to be in Canada no less than 17,764,000 electrical horse-power available by water powers, and of this enormous amount only 8.2 per cent .was as yet utilized.

This, he said, meant that there was in the Dominion an immense field of potential wealth awaiting development. So far, the chief way in which the Canadian water powers had been developed was in the production of electricity for light and power, but with the immense power now running to waste there was untold opportunity for the development of electro-chemical and electro-metallurgical industries. It was undoubted, he said, that many water powers could be profitably harnessed in connection with these industries. He instanced the production of calcium carbide, which was in great demand; the electric production of nitrate of lime for fertilizers, as was successfully being done in Norway; the production of nitric acid, calcium, cyanamide, and the electrical production of aluminum, zinc, nickel and copper, as well as high-class steel for tools.

More Publicity Needed.

Mr. Surveyer argued that the lack of development was partly due to lack of knowledge regarding the possibilities of profitable development of these water powers. To overcome this, he suggested that the various Governments, Dominion and Provincial, should undertake a systematic series of surveys of water powers, and publish the results, so as to make them available for manufacturers and investors .

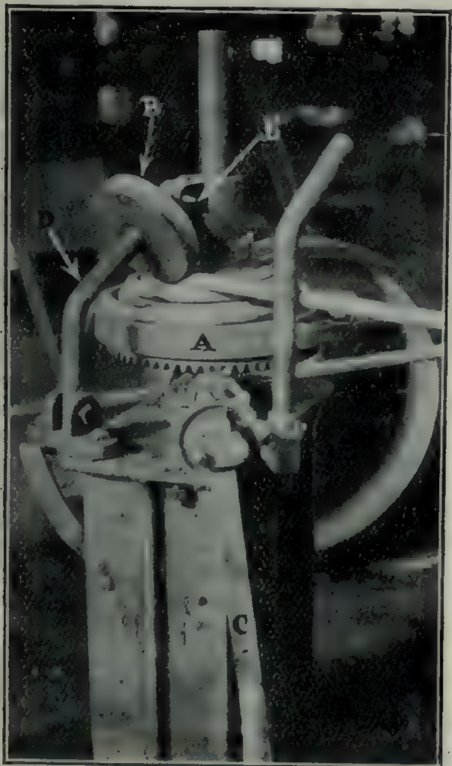
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A NOVEL PIPE BENDER

By E. Avery.

A DEVICE for beinding heavy copper pipe into a coil, for use in a condensing apparatus is here shown. The pipe is three-quarter inch, and is heavy enough to bend without the need of filling of any kind. One end of the pipe is threaded and has an elbow screwed on. This is placed back of a pin set into the lower end of the "thread" of the master-form A. The grooved roller B is then set against the pipe, and the form is revolved by turning the handle C. As the pipe is gradually bent round the "thread" of the form, the roller travels up the bar D accordingly, and when the coil is completed, the pin E is pulled out and the bar and roller thrown back, leaving the coil free to be lifted off.



A NOVEL PIPE BENDER.

IRREGULAR SPACING FOR REAMERS.

By D. S. Mann.

FOR reamers and boring heads of the long-blade type, it is desirable to have the blades unevenly spaced in order to break up the cutting and thus prevent chattering. It is also desirable to have the blades on the two sides of the body exactly opposite in order to easily determine the diameter. The table gives the number of turns for the dividing head for from 4 to 24 blades (or flutes). The movements are but for one-half the reamer and should be repeated for the other half.

Number of Flutes.	4	6	8	10	12	14	16	18	20	22	24
Turns for Dividing Head.	9 1/2	6 1/3	4 1/4	3	2 1/2	2 3/7	2	1 7/9	1 11/20	1 4/11	1 5/24
	10 1/2	6 2/3	4 3/4	3 1/2	2 5/6	2 4/7	2 1/7	1 8/9	1 13/20	1 5/11	1 7/24
		7	5 1/4	4	3 1/6	2 5/7	2 2/7	2	1 15/20	1 6/11	1 9/24
			5 3/4	4 1/2	3 1/2	2 6/7	2 3/7	2 1/9	1 17/20	1 7/11	1 11/24
				5	3 5/6	3	2 4/7	2 2/9	1 19/20	1 8/11	1 13/24
					4 1/6	3 1/7	2 5/7	2 3/9	2 1/20	1 9/11	1 15/24
						3 2/7	2 6/7	2 4/9	2 3/20	1 10/11	1 17/24
							3	2 5/9	2 1/4	2	1 19/24
								2 2/3	2 7/20	2 1/11	1 21/24
									2 9/20	2 2/11	1 23/24
										2 3/11	2 1/24
											2 1/8

IRREGULAR SPACING FOR REAMERS.

A PIPE DRILLING FIXTURE.

A PIPE DRILLING FIXTURE.

By A. E. Granville.

THE accompanying photograph illustrates a fixture used for drilling evenly spaced holes in header pipes. This device was made by the Artic Ice Machinery Co., Canton, Ohio, for use in their own shops. The pipe to be drilled is laid in the V-blocks A and clamped down with the straps shown. The carriage or slide to which the V-blocks are bolted, has a rack running along the bottom, into which a pinion operated by handle B meshes, so that the operator can easily run the pipe along as needed, in either direction. Holes are drilled one inch apart along the side of the slide, as shown at C, and a pin D is used to insert in these holes and lock the slide as it is moved the required space. An adjustable bracket E carries a drill

bushing to guide the drill into the pipe. This bracket and bushing may be removed altogether when tapping out the drilled holes. Holes drilled and tapped in this fixture will all be correctly spaced and pipes screwed into them will be parallel.

THE DYNAMIC BALANCE OF PULLEYS.

By C. Causev Smith.

IN a Western manufacturing plant whose product consists very largely of lumber mill machinery, there occurred a costly little incident that resulted in the development of a simple way out which has proved useful upon many subsequent occasions. An engine belt had been

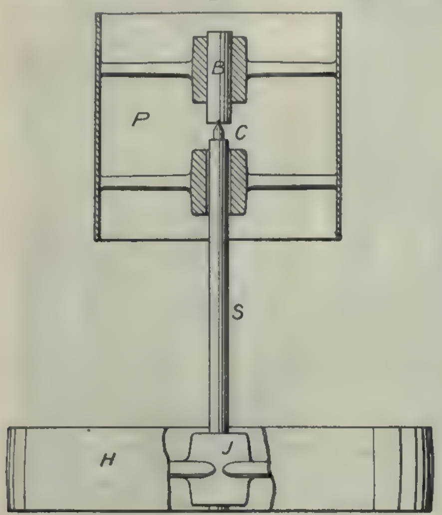


FIG. 1. TEMPORARY METHOD OF TESTING PULLEY FOR RUNNING BALANCE.

equipped with a tightening device which consisted of a wooden frame and an idler pully. The framework was securely bolted together and swung on a shaft at its upper end so that the other end which carried the pulley was free to move up and down as the tension of the belt demanded.

The pulley was twenty-four inches in diameter, had a face of thirty inches and ran at a speed of 620 r.p.m. Upon the engine being started up for a trial run, the engineer complained that the idler pulley was very much out of balance. Upon examination his claims seemed to be well substantiated. The pulley being some eight feet from the hinged end of the frame which was its only point of support seemed likely to shake down the whole affair. It was immediately ordered back to the shop with some curt directions that it be balanced.

The man who had balanced it was somewhat mortified to see his job given to another mechanic to check up. This man, however, on placing it upon the rails found it very nearly correct. Being doubtful, he smoothed and leveled his bars and tried it again only to find that his predecessor's work was substantially right. The job being wanted in a hurry, little more thought was given the matter and the pulley again sent to its destinationly only to cause the same trouble as before and considerably more ill-feeling on the part of the engineer.

The matter was called to the attention of the superintendent, who, upon arriving at the mill and hearing and seeing the actions of the tightener was not long in ascertaining the cause of the trouble. The troublesome pulley was again brought to the shop and, upon examination, was found to be originally out as shown at B, Fig 3. The man who had attempted to correct this had done so by placing the balance weight of 2⅜ pounds at the other end and on the opposite side as shown at C which, according to his ideas of static balance should accomplish the desired end.

A little consideration of the figure, however, will show that, while the balance weight thus placed effectively balanced the pulley while at rest, its running or dynamic unbalance was very much increased. The centrifugal force of the two unbalanced weights tended to form a couple about the centre of the pulley and produced a wobbling force which, at the full speed of the engine, became enormous. The correct position of the balance weight is, of course, at A directly opposite the centre of gravity of the unbalanced weight of the pulley.

A Temporary Device.

The method adopted for correcting the running balance is shown in Fig. 1. A spindle S was made up of a piece of 1 7-16-inch cold rolled shafting by drilling a hole in the end to fit a hardened centre C which belonged to a tapping outfit of one of the radial drilling machines. A pulley H was procured for a support or base plate and the upright spindle was fastened into the hub J by driving a couple of half bushings belonging to a wood split pulley between it and the spindle. A short piece of 2 3-16-inch cold rolled was now centred and driven lightly into the hub of the pulley to be balanced so that the centre in the end of the plug B would be just slightly above the centre of gravity of the pulley P as shown.

A line was drawn square across the face of the pulley at the centre of the balance weight location as had been determined by static balance. The weight was now removed and a ball of clay made up of exactly the same weight. All that was now necessary was to hang the pulley upon the point as shown and spin it around by hand marking the wobble as when truing up a piece in a lathe. After a number of trials and moving the clay along the line each time the point was found where it would balance the pulley perfectly at any speed. This position on the line was marked and the balance weight carefully fastened at this point. The pulley upon being again set up was found to balance perfectly.

A Simple and Efficient Machine.

As a considerable amount of this work was to be done, the machine shown in Fig. 2 was designed and built to do it expeditiously and to do away with the labor of spinning and stopping heavy pulleys by hand. The base or frame A is in the form of a heavy angle plate with one side resting on the floor. The vertical spindle E is supported in a pivot bearing T and a solid babbited bearing further up. It is driven by means of a belt through a beveled paper friction whose friction pressure can be regulated by the set-screw and lock-nut as shown.

The sleeve L slides up and down on the vertical spindle by means of the lever H and, as it is fitted with a feather key at its lower end which fits into a corresponding keyway in the spindle, it revolves with the vertical shaft. This sleeve and lever are counterweighted by means of the weight W. The sliding part B is also in the form of an angle plate with the hori-

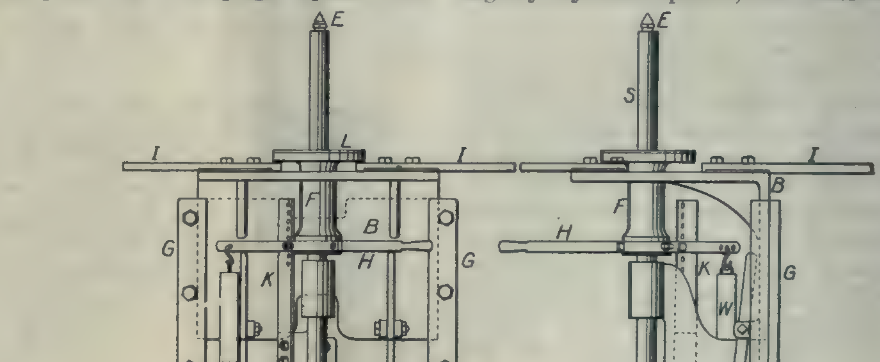


FIG. 2. MACHINE DESIGNED TO DETERMINE RUNNING BALANCE OF PULLEYS.

zontal side uppermost and the back sliding in the guide G. This is raised by the foot-pedal O through the horizontal shaft and the two lever arms Q and the links M.

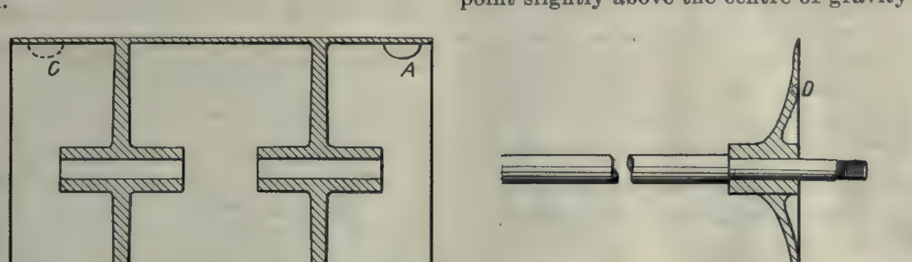


FIG. 3. EFFECT OF STATIC BALANCE ON PULLEY AND SAW ARBOR.

The top face of this angle plate is chambered out so as to clear the flange of the sleeve and is provided with grooves for holding the three wooden arms I which are bolted to it. These arms project radially 120 degrees apart and are of such length as to support the pulley to be balanced by the rim.

The method of procedure is as follows. The pulley is first statically balanced, as it has been found the quickest way to determine the amount of unbalance and the radial location of the balance weight. Substituting the centre plug for the arbor as before described, the pulley is hung upon the point C so that its centre of gravity is barely supported. The machine is now started up and the sleeve L is raised until the top of the flange which is leather-faced, presses sufficiently against the hub of the pulley to give it the desired speed. When the chalking is done, the pulley is quickly brought to rest by the foot treadle which raises the three radial wood arms against its rim with any desired pressure. Some little trouble is experienced upon starting if the pulley is badly out of running balance, but enough speed to indicate the unbalance is easily attained in any case. For different sizes of pulleys the lever H can be adjusted up and down the post K and, in the same way, the links M can be shortened or lengthened at their connections to the angle plate. The outfit is completed by suspending an air drill by a counterweight so that the drilling and countersinking can be done on the spot and without requisitioning a large drill press.

Dynamic and Standing Balance.

It is evident that dynamic balance becomes more important as the width of the pulley face increases. In the case of the saw arbor in Fig. 3 the drilling of holes such as is done at D serves to balance the disc both statically and dynamically while in the pulley if the weight be wrongly placed as at C, Fig. 3, the effect is to aggravate the original trouble. There are ways of statically balancing pulleys and discs, which give even more accurate results than the balancing rails. These have mostly been developed by the necessities of the steam turbine, centrifugal pumps, blowers, etc. The disc may be freely suspended by a pair of cone centres from a point slightly above the centre of gravity and simply leveled up by balance weights. The dynamic balance is secured by attaching this outfit to the spindle of a drilling machine and rotating it at a speed sufficient to indicate its running unbalance. Very much can be added to the quality of ordinary narrow-faced pulleys which are balanced statically if the mechanic will take the trouble to determine by examination the approximate location of the unbalanced weight and so place the balancing weight as to neutralize its centrifugal force as well as its dead weight.

DRILLING AND GRINDING FIXTURE.

D. O. Barrett.

THE drawing, Fig. 1, shows a part used on a gasoline engine for supporting the lever operating the exhaust valve. This is held in place by two of the head studs and is disk ground on the two pads which set against the stud bosses. The boss on the post carrying the lever is finished by spot facing.

The first operation is that of disk grinding the two pads, and this is done by the fixture in Fig. 2. These were formerly held merely by hand, but, as the casting was not very broad, more would be ground off the one side than the other and the levers would not then line up properly with the valve stems; a great amount of filing being afterwards necessary. The fixture is bolted on the sliding table of the disk grinder, and the piece is placed between the two V-jaws, one of which is slidably mounted, and may be pulled back by the pin projecting from the end. This jaw is pushed up by a flat spring. The fixed V at the back locates the boss on the post correctly and, having placed a casting in the jaws in somewhere near the proper position, it is held there by the spring jaw until further pressure is brought to bear upon it. When the casting is now brought up against the grind-

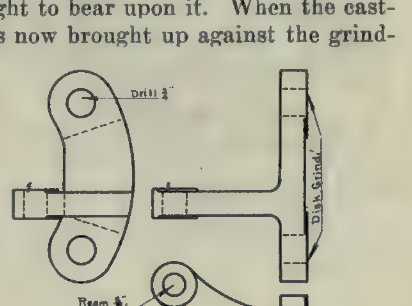


FIG. 1. SUPPORT FOR LEVER OPERATING EXHAUST VALVE.

er disk lightly, it is pushed back into the fixed V and the two pads will be lined up evenly when the sliding jaw is locked by means of the lever nut. Any further grinding causes the casting to heat which will aid in clamping it still tighter.

The drill jig is of box form with one open side. The casting is held between two jaws of exactly the same shape as in the grinding fixture so that it will be located in exactly the same relative position. In this case, however, the movable jaw is pushed away from the casting. Instead of towards it by two springs

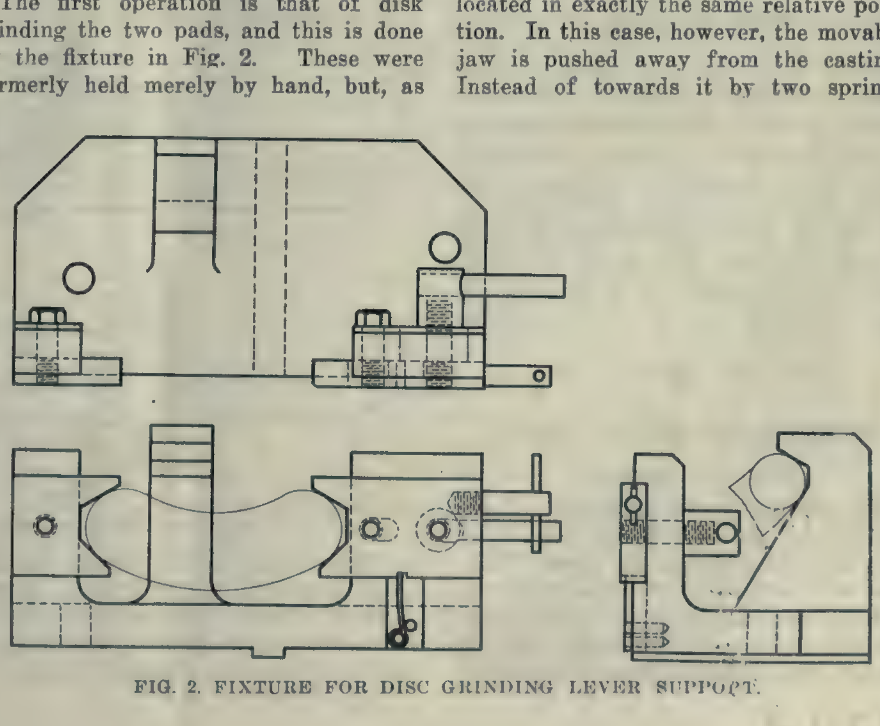


FIG. 2. FIXTURE FOR DISC GRINDING LEVER SUPPORT.

which are of helical form and located in two drilled holes closed with plugs, these springs pushing against the studs by which the jaw is held in place. This jaw is pushed up against the casting by a T-head screw projecting from the one end.

Two wedges are driven in across the feet of the casting after it is centered between the jaws, while a third is merely pushed in by hand to take the thrust of the drill and facer when operating on the post. The drill bushing for the hole in the post is carried in the steel cross arm which is hinged at the one side. The other side is provided with a snap clasp so that the bar is merely pushed down into the slot and locked there automatically. The drilling is done with the jig on end, and after drilling the hole in the post, it is necessary to swing back the bar for reaming and facing. In order to make it possible to unlatch and remove the bar with the one hand, a small plunger provided with a rather stiff spring is placed under the bar near the hinge; as soon as the bar is unlatched this spring immediately pushes out the bar. Having to reach down into the jig so far necessitates having the box somewhat larger than would be necessary were it possible to drill and ream the hole from the other side, omitting

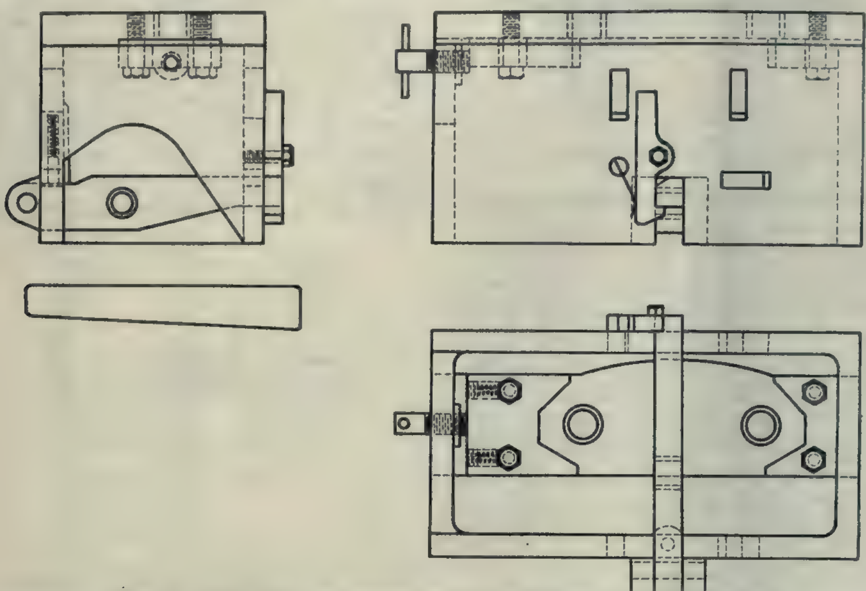


FIG. 3. DRILLING FIXTURE FOR EXHAUST VALVE LEVER.

SOME POINTS IN JIG DESIGN.

By. A. L. Monrad.

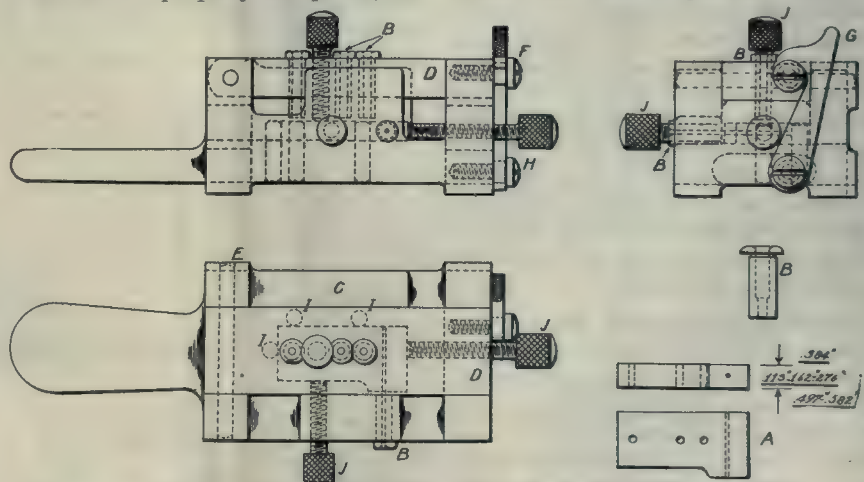
THE drill jig shown herewith is cheap and simple, yet very effective in the production of interchangeable parts. There are six different thicknesses of the model A shown. The location and shape are alike, the same jig being used by simply changing the different lengths of the bushings in the leaf to the different thicknesses of the work to be drilled. The drill bushings of a slight driving fit, are made of the best grade of tool steel hardened and lapped, and ground inside and outside. When grinding the inside of a long bushing the upper part should be relieved, either by tapering out or by increasing the diameter of the hole about .010 inch as shown at B, and to a depth about twice the diameter of the drill employed, from the bottom end of the bushing. Some designers are inclined to locate the bushings so that the thin lower end will stop about the same distance above the work as the diameter of the drill, in order that the chips clear the bushing readily. The writer has found it most practical to locate the bushing very close to the work—about .005 inch from the working surface.

If the drill is properly sharpened, all the chips will slide freely through the spiral groove of the drill while in the bushing. On the other hand, if the bushing be placed above the work, all the chips will clog in between it and the work, and the result is, that when withdrawing the drill, the chips will cling to the spiral groove of the drill, and come out between the bushing and the work. This is often the cause of a drill being bent and broken. Then, too, if a hole be half drilled, it is not practical to get all the chips out between the bushing and the work. When starting to drill again, the point of the drill always catches the flat chips and drags them down into the centre of the hole, thus forming a shoe on the point of the drill, which prevents it from cutting. Another feature found very practical is not to round the corner of the bushing in the bottom end, but to have it sharp or square. In so doing, the chips will not cling in between, but follow the spiral groove of the drill.

It is not as a general rule good practice to place a handle on a drill jig, but this particular case is an exception. When relieving the work from the jig, the top screw is manipulated the same as a handle. First, unloosen all the knurled finger screws from the work in the jig by pressing the right hand thumb on the cam, thereby releasing the lever. With the left hand on the top screw, swing open the leaf. As the handle is low, the jig cannot tip over. Some designers place the head of the bushing on the inside of the leaf to serve as a support for the work to be drilled. This is very good practice in cases where one or more holes are at right angles with the leaf, as it makes a small bearing surface to keep clean, and it means that the drill must start accurately.

The jig frame C, is made of hard fine grain cast iron and finished all over to dimensions. A low grade tool steel leaf D is fitted snugly in the centre of the frame, and held in position with a 1/4 inch straight pin E. These holes should be drilled, bored and reamed on a face plate in an engine lathe in order to get them perfectly square with the leaf and

(Continued on page 52.)



JIG FOR DRILLING PIECES OF DIFFERENT THICKNESSES.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

PROBLEMS RELATING TO SCREW THREADS.

A SCREW thread in its simplest form is a continuous wedge or inclined plane. If the length of the wedge be considered equal to the circumference of the screw, its height will be equal to the pitch. This can be easily proved by cutting a piece of paper to the proper wedge shape and wrapping it around the screw or rod. The angle of the inclined plane depends upon both the pitch and the diameter of the screw. In calculating the power transmitted by screws, it must be borne in mind that the friction is a variable and an unknown quantity. An average value might be taken as 50 per cent., but it increases very rapidly, and is much greater than this at higher loads.

* * *

Question.—A planer raising screw is driven by a belt through a 14-inch pulley and a gear and pinion of 96 and 12 teeth respectively. The pitch of the screw is $\frac{1}{4}$ inch and the belt speed is 800 feet per minute. How long will the arm require to rise 40 inches?

Answer.—Speed of pulley

$$= \frac{800}{14 \times 3.1416} \times \frac{12}{1} = 992.06 \text{ r.p.m.}$$

$$\text{Speed of screw} = \frac{992.06 \times 12}{96}$$

= 124.0075 r.p.m.

$$\text{Speed of arm} = \frac{124.007}{4} = 31.0018$$

inches per minute.

Time required to raise planer arm

$$= \frac{1}{31.0018} \times 40 = 1.29 \text{ minutes.}$$

* * *

Question—A single threaded mild steel screw with outside diameter of $3\frac{1}{8}$ inch has a 5/16 square thread. What length of hold would this screw require to have on the nut in order to make the shearing strength of the thread equal to the tensile strength of the screw not counting tensile strength of thread?

Answer.—A screw is usually made to exact dimensions any allowance for play being made in the nut. Length of shearing surface = circumference of screw = 2.5 × 3.1416 = 7.854 inches. Tensile strength of steel = 60,000 pounds per square inch. Tensile strength of screw = 2.5 × 2.5 × .7854 × 60,000. = 294,522 pounds.

Shearing strength = 50,000 pounds per sq. inch.

Shearing surface for every inch of length = 7.854 × .5 = 3.927 sq. ins.

Shearing strength for each inch of length = 3.927 × 50,000 = 196,350 pounds.

Length of screw required

$$= \frac{294522}{196350} = 1.5 \text{ or } 1\tfrac{1}{2} \text{ inches.}$$

* * *

Question.—In the above problem, using a safety factor of 4, what length of brass nut would be required to develop the full strength of the screw?

Answer.—Shearing strength of brass is 36,000 pounds per square inch. Length of shearing surface = 3.125 × 3.1416 = 9.817 inches.

Shearing surface required

$$= \frac{294522 \times 4}{36000} = 32.724 \text{ sq. inches.}$$

Allowing .01 inch play, we have for every inch of length $\frac{.3025}{.625} = .484$ inch of shearing length or shearing surface = .484×9.817=4.7514 sq. inches.

$$\text{Length of nut required} = \frac{32.724}{4.7514}$$

= 6.89 inches.

* * *

Question—What force could be exerted by means of a jack screw, the pitch of which is $\frac{1}{2}$ inch by means of a lever of such length that a pressure of 60 pounds is exerted 30 inches from the centre of the screw? Friction is 48 per cent.

Answer.—The load multiplied by the distance through which it moves equals the power multiplied by its distance. The distance through which the power moves = 30 × 2 × 3.1416 = 188.496 inches. The power = 60 pounds. The load moves $\frac{1}{2}$ inch.

$$\text{Load and friction} = \frac{188.496 \times 60}{.5} = 22{,}619.5 \text{ pounds.}$$

$$\text{Net force} = \frac{22619.5}{100} \times \frac{52}{1} = 111762.14$$

pounds.

* * *

Question—A mechanic uses a 20-inch wrench for screwing down $\frac{3}{4}$ inch nuts on a cylinder head. Assuming friction to be 72 per cent., and that the nuts are amply strong, what pressure on the wrench would be required to stress the mild steel studs up to the elastic limit?

Answer.—For v-thread, the diameter at the bottom of the thread is .5768 inch. Area of this section is .26129 sq. in. Assuming the elastic limit to be half of the ultimate strength, possible load sustained by the bolt is .26129 × 30,000 = 7838.7 pounds.

Circumference of wrench circle is 40 × 3.1416 = 125.664 inches.

A $\frac{3}{4}$ nut has 10 threads per inch or travel of nut is 0.1 inch per revolution. Speed ratio is therefore 1256.64 to 1, or, taking friction into account, 1 pound pressure on the wrench produces a tension of $\frac{28}{100} \times 1256.64 = 351.859$ lbs.

A tension of 7838.7 pounds then, would be produced by a pull of $\frac{7838.7}{351.859} =$ 22.27 lbs.

* * *

Question.—A locking device consists of a right and left hand screw of 4 pitch operated by a 10-inch hand wheel and a toggle, each arm of which is 10 inches. What outward force would be exerted by the toggle if 30 pounds be applied to the hand wheel, the distance between the two nuts and the two arms of the toggle forming the side of an equilateral trangle.

Answer.—Circumference of hand wheel is 10 × 3.1416 = 31.416 inch. Travel of nuts at one revolution is 0.5 inch. The force tending to draw the nuts together is $\frac{31.416 \times 30}{.5} = 188.496$ pounds.

Neglecting friction, the thrust = 188,.496 × tan 60 deg. = 188.496 × 1,732 = 326.476 pounds.

* * *

Question.—A 1-inch nut is 1 inch thick and is tightened down to the full strength of the bolt. Neglecting the thread, how thick should the metal be on the sides to resist bursting?

Answer.—The smallest diameter of a 1-inch bolt with a U.S. standard thread is 0.838 inch. Area of section=.838× 60,000 pounds per square inch, the ultimate strength of the bolt = .5515×60,000 = 33,090 pounds. The angle of the thread is 60 degrees. The vertical force must be 33,090 pounds.

The bursting force, which is the horizontal component of the whole force acting at right angles to the face of the thread, is 33,090×tan 30°=33,090× .57735 = 19,104 pounds.

The stress in the nut $= \frac{19,104}{2} =$ 9,552 pounds. This, allowing 40,000 pounds per square inch, requires $\frac{9,552}{40,000}$ $= 0.2388$ square inches. That is, the nut being 1 inch high, would require approximately $\frac{1}{4}$ inch of metal, or $\frac{1}{8}$ inch on the side, to resist bursting.

SOME POINTS IN JIG DESIGN.

(Continued from page 50.)

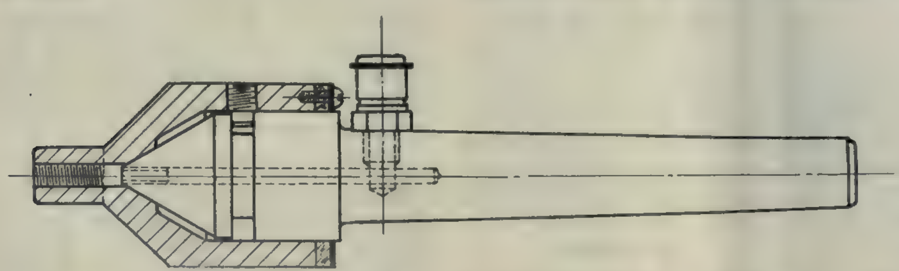
the jig. On the other end of the leaf is placed a shoulder head screw F, fitted to the finger cam G, also located with a shoulder head screw H. These are all made of low grade tool steel hardened and drawn to a dark straw color. The stop pin I, hardened and driven in the frame, locate the work with the aid of three case-hardened, knurled finger screws J.

When the jig is assembled with a sample model in position and locked in the jig, lay out the holes approximately for bushing; drill through the frame and leaf, allowing enough for boring; clean the jig thoroughly and place the original with a female centre in each hole to be bored. Indicate the jig on the face plate, bore and ream these bushing holes to size, and the jig is complete to receive the bushing B.

LATHE OR GRINDER CENTRE.

By R. G. Dickens.

THE following description of a lathe or grinder centre for hollow cylindrical work may be of interest to readers of Canadian Machinery, having such jobs as automobile wrist pins to finish turn or grind.



LATHE OR GRINDER CENTRE FOR HOLLOW CYLINDRICAL WORK.

The centre is used in one of the largest auto plants in the States, and has been very satisfactory wherever used. It consists of two main parts as shown, both of which are hardened and ground as required, the centre being a good running fit in cap at large diameter, and at extreme point for about $\frac{3}{8}$ of an inch.

The various parts are held together by a headless set screw and are lubricated through Winkley oiler as shown. The felt ring is held in place by sheet brass ring and two screws, and is for the purpose of retaining the lubricant and excluding grit and dirt. The general appearance is plainly indicated by the sketch and needs no further explanation.

HIGH-PRESSURE WATER HEATING.

THE total number of explosions of high-pressure heating coils investigated by the British Board of Trade from the year 1887 to 1913 was 63, says Vulcan, and in no less than 54 cases the cause of the accident was due to the pipes being choked with ice. A few explosions occurred during the month of December, and about double the number in February, but more accidents took place in January than in any other month. These explosions cause dthe death of five persons and injury to 31 others.

The system of heating buildings by water at a high pressure dates back to 1831, when a patent was taken out and was described as "Perkins' heating by small-bore pipes." With the present-day heating coils, there is a good deal of uncertainly as to the actual pressure in the pipes under working conditions. This type of heating is undoubtedly subjected to extreme pressures in the event of the fire being forced or by the circulation defective, as many accidents have occurred by burst pipes, which when new will sustain a water test of 4.000 per square inch. The most common cause of an explosion is the blocking of the pipes by ice in frosty weather. Imperfect circulation of the water and the presence of air in the pipes is another source of danger.

System in Simple Form.

The most simple form of this system of heating is a coil of piping at the furnace, the upper end being led round the building, returned and attached to the lower end of the coil. The piping is filled with water and sealed. the coil encased in brickwork or a casting, and the usual firebars and firing door fitted. With some makes the boiler portion is composed of pipes of larger diameter fitted in the form of a letter A. the cross bar of the A being the fire bars or grate. In another form the larger tubes at the furnace end are fixed horizontally in the form of a circle with the the fire inside or underneath. The smaller tubes are about 1 5-16 in. outside diameter and $\frac{7}{8}$ in. bore, and are generally wrought iron and lap welded longitudinally, the connections being made of strong unions screwed with a specially fine (15 to the inch) right and left handed thread. The ends of the tubes are also arranged to make a metallic joint when butted together.

Provision is made at the highest point of the system for the increased volume of water in the pipes through expansion when heated. This is called the expansion chamber or pipe, and is usually about three to four inches diameter and from three to six feet high. The expansion pipe should be fixed vertically above the filling pipe, which is a short vertical branch fitted with a screwed plug, and should also have a screwed plug at the side to prevent over-filling. This should be removed when the pipes are filled up. Some makers, however, do not fit expansion pipes, and in their place the upper end of the system is connected to a small safety valve with an inlet valvet beneath. Both these fittings are immersed in a small tank of water and the safety valve is supposed to act in the event of over-pressure or excessive expansion and the inlet valve to supply the necessary water to the system when the pressure and heat have gone down. The safety valves range from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. in diameter and are loaded to 500 to 1.000 lbs. per square inch or more. Occasionally both expansion pipes and safety valve are fitted, but generally only expansion pipes are fixed, these being not so liable to get out of order as the combined safety and inlet valve.

Filling the System.

The pipes are originally filled with water by means of a force pump; the pump being attached at the extreme low point near the furnace where there should be a special branch for the purpose. This method of filling is to avoid, if possible, air pockets forming in the pipes which would be more likely to occur if they were filled from the top. Most makers also advise that the pipes should be pumped through every year for the purpose of driving out any air that may have accumulated. The filling pipe previously referred to at the top of the system is merely a replenishing convenience, and should be used about once a week. The volume of the expansion pipes is generally taken at about $\frac{1}{8}$ or more the capacity of the whole piping, so that in a system of, say, 1,000 feet of piping at $\frac{7}{8}$ internal diameter, about six feet of expansion pipe 4 in. diameter would be required. It is also usual to use about one-tenth of the piping around the furnace which, in larger installations, would range from 200 to 300 feet.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

AUTOMATIC TAPPING MACHINE.

THE three machines illustrated were made by the Garvin Machine Co. of New York city, and are the latest additions to their well-known line of automatic tapping machines. Fig. 1 shows their No. ½ combination automatic tapping machine, which is virtually their No. 2 machine equipped with a No. 1 head and which meets the need of a machine for work having two holes of such a difference in size that it would

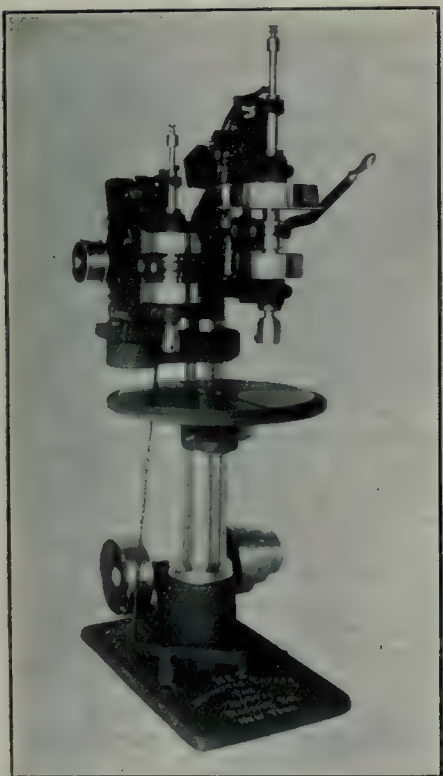


FIG. 1. NO. 1-2 COMBINATION AUTOMATIC TAPPING MACHINE.

not be practical to have both heads of the same capacity. The No. 1 head, it will be noticed, can be operated either by lever or foot treadle, while the No. 2 head is operated by lever alone. Each head is independent of the other.

Fig. 2 is their No. 1-2-X, combination automatic tapping machine, showing another combination of the No. 1 and No. 2-X sixes of heads. Both heads are operated in this instance by foot treadle, leaving both hands of the operator free, and the No. 2-X head is of greater capacity than the No. 2 head on the machine previously described.

Fig. 3 illustrates their No. 2-X four spindle automatic tapping machine. The spindles are operated in pairs, and are controlled by independent lever, the two on the right being used for rough tapping and the two on the left for finishing. The work consists of a deep hole in tool steel, necessitating rought tapping before finishing, this being done with but one clamping. The fixture is moved along the slide from one pair of spindles to the other. The general operation of these machines is the same as the firm's regular automatic tapping machines. The spindles are fitted with two friction pulleys running in opposite directions and, after the top is once started, the machines work automatically, tapping the hole to a predetermined depth, controlled by automatic trip, and reversing the tap.

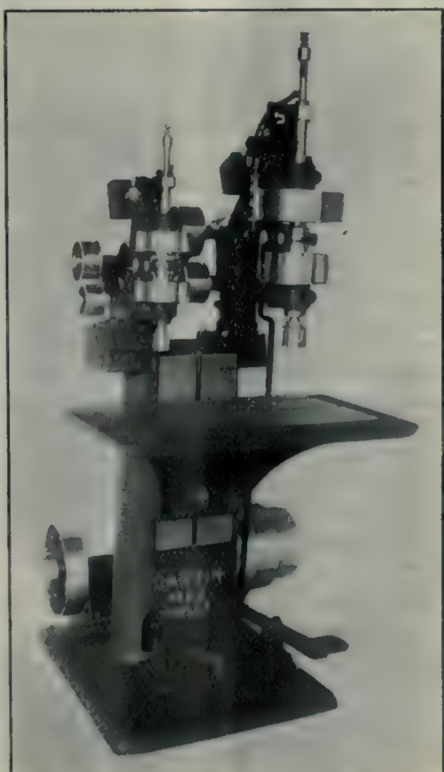


FIG. 2. NO. 1-2-x COMBINATION AUTOMATIC TAPPING MACHINE.

HIGH-SPEED ELECTRIC LOCOMOTIVES.

DURING 1914, sixteen high-speed electric locomotives have been placed in main line passenger service of the New York Central Railroad. This type, states the Railway News, is claimed to be the most powerful electric passenger locomotive thus far constructed, and is capable of continuously hauling a train of fourteen steel Pullman cars at a sustained speed of 60 miles per hour. With lighter trains the maximum speed of these locomotives is 85 miles per hour. The electrical features are generally the same as in the original electric locomotives first operated by the company eight years ago.

The new locomotives weigh 132 tons and the great increase in capacity, compared with the comparatively slight increase in weight, is due to the fact that motors have been placed on the axles of the leading and trailing bogie truck wheels, thus avoiding all dead weight, all the wheels being driving wheels, the entire weight of the locomotive being thereby available for producing tractive effort or draw-bar pull.

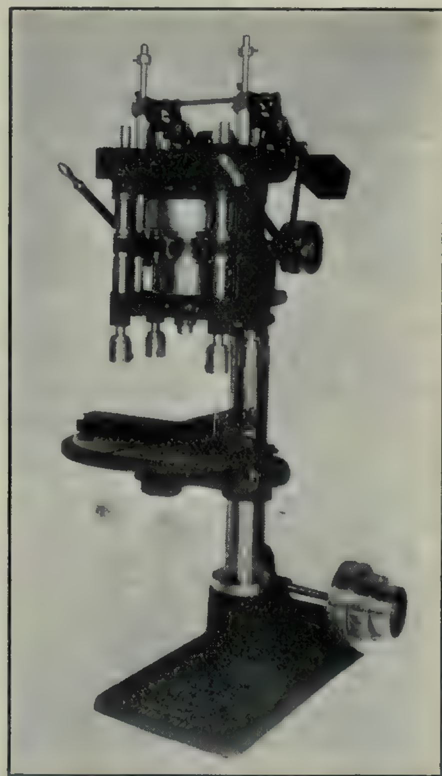


FIG. 3. NO. 2-x FOUR SPINDLE AUTOMATIC TAPPING MACHINE.

THE NEW WILLSON GOGGLE.

T. A. WILLSON CO., Inc., Reading, Pa., have recently placed on the market a new goggle specially designed to meet the requirements of machinists and grinders. This goggle has a unique construction, and is claimed to offer workmen complete comfort and perfect eye protection.

By the use of a special frame design, this goggle is made light in weight, yet substantial, due to sturdy eye wire, temples, etc. It will stand rough shop usage. An adjustable bridge enables the wearer to easily fit the glasses to his

face. This bridge is pliable, strong and securely attached to the eye wire, and does not touch the top of the nose at all, but the weight of the glasses is distributed over the sides of the nose and cheeks. Not resting on the nose, the glasses can be worn right over spectacles.

It is of the greatest importance that grinders and machinists be protected from dust, emery, and grit, which whirl around the sides of glasses. Side guards are necessary, and the light fine mesh wire sides of the Willson goggle contribute to complete protection, and are at the same time comfortable. Fine quality glass is used to insure freedom from eye strain.

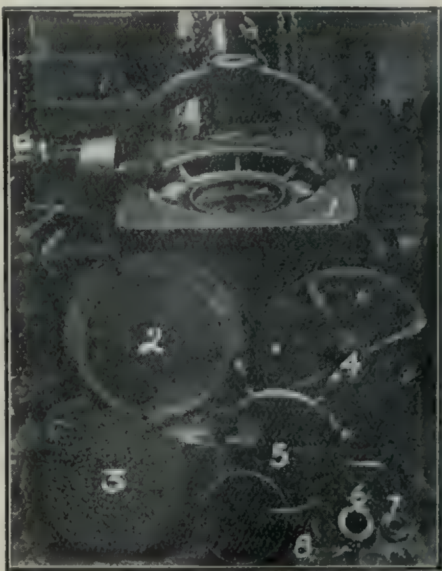
Being made entirely of rust-proof metal, this goggle is perfectly sanitary, and can be thoroughly sterilized. Comfort is further assured by the flexible half cable temples, which easily conform to any face, and do not pull or cut into the ears. Lenses can be easily and quickly replaced by simply loosening one of the screws of the end piece.

A NEW FACER BUFFER AND POLISHER.

THE straightening of flat or dished disks by hand is a tedious and difficult process and has, in fact, been regarded as a trade in itself, particularly when applied to circular saws and similar plates which require not only to be trued up but to be given a certain initial tension. In the accompanying illustration, is shown a machine designed for this purpose. It is properly known as a ball bearing, double plate rotary facer, buffer and polisher and was designed by Wm. Gibbs, of Brantford, for the purpose of straightening and polishing disk plats for plows, seed drills, plough coulters, grinder plates, saws, etc. Any disc up to 18 inches in diameter and up to ¼ inch thick can be conveniently handled by the machine.

The body of the machine is shown by numeral (1). This contains the grooved ball race which supports the bottom revolving plate upon a large circle of ⅝ balls. This plate along with the upper revolving plate is driven by bevel gears attached to their outer edges. The driving is done by the small bevel pinion between the two plates as shown which obviously causes them to rotate in opposite directions. The bottom plate contains a 4-inch boss which fits into a corresponding depression in the base of the machine and, of course, is fitted with the steel ball race; the whole running in a bath of oil and giving a solid and uniform bearing capable of carrying a working load of seven tons.

The peining or straightening is done by the plate (3) which contains a large number of spirally arranged, hardened balls and the spiral arrangement insures that no two balls follow exactly the same circle on the disc. The effect of thus rolling the plate is to place every part of the surface under a uniform tension and it leaves the machine, after 15 seconds treatment, perfectly flat and straight. The upper plate is shown at (4), while at (5) is the hand wheel for adjusting the pressure between the plates. At (6) is shown half of the small nut with the groove (7) in the upper half; (8) is a roller bearing sup-



BALL-BEARING BUFFING AND POLISHING MACHINE.

porting the screw. The weight of the complete machine with all attachments is 1,350 pounds.

The machine is driven by a belt so as to give either a polishing or a rolling speed. The work to be straightened and polished is first placed between the ball plates and sufficient prssure applied by means of the hand wheel and screw, this depending upon the nature of the material. After the batch has been thus peined at a speed of 300 r.p.m., the ball plates are exchanged for emery discs, the machine speeded up to about 1,800 r.p.m., and the work polished under a comparatively slight pressure. This change is accomplished in about five minutes by removing the four bolts shown by numeral (4). The whole constitutes a machine covering a wide range of difficult work and occupying little floor space.

TYPES OF SHELLS.

THERE are in use in the British navy at the present time three different kinds of shell. Each type has its own distinctive duty to perform, and the work done by each is as follows:

Armor piercing shell.—Inflicting a fatal blow on the enemy by damaging a vital part. Since these parts are all protected by armor the shell has to pierce the armor before it can be effective.

Common shell.—The destruction of material.

Shrapnel.—Man-slaying.

The early armor-piercing shells were made of cast iron, which, when wrought iron armor was introduced, were hardened at the points by a patent process. When compound armor was fitted, these shells were made of forged carbon steel. With improvements in armor, shells were required of correspondingly harder material, and various quantities of nickel, chromium, and sometimes tungsten, have been used with success.

Each country has a secret process for manufacturing its armor-piercing projectiles, which has for its purpose the hardening of the head and the tempering of it in such a way that the rear portion is reduced in hardness and rendered very tough. The cavity of these projectiles is filled with a small bursting charge, varying between two and three per cent. of the weight of the whole projectile. These shells, whether fused or not, burst on striking armor of medium thickness. With all the improvements in armor-piercing shells, they cannot be reckoned as capable of piercing armor of more than a calibre in thickness.

Common shell generally carries an enormous bursting charge of melinite, lyddite, or some such explosive. They burst into small pieces, and are used for the destruction of material.

Shrapnel, which is filled with bullets, is essentially a man-slaying projectile, the explosion of the charge in the base of the shell driving the contents forward, and sweeping a wide area.

DECEMBER TRADE DECREASE.

A FURTHER decrease in Canadian trade is indicated by the December trade statement just issued by the Minister of Customs, Hon. J. D. Reid. Imports dropped about $22,000,000, the figures for December of this year being $31,454,883, as compared with $52,571,831 last year. Exports were $37,513,624, as compared with $55,803,676 in the corresponding month last year.

On the other hand, there was an increase in the exports of manufactured goods of $2,000,000 in December and $12,000,000 for the nine months of the fiscal year. There has also been an increase in the exportation of animals and animal products, though that of other agricultural products has decreased.

The balance of trade against Canada is gradually decreasing, December exports being $6,000,000 greater than imports, although the latter total has been swollen of late by importations of coin and bullion.

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Vol. XIII. JANUARY 21, 1915 No. 3

PRINCIPAL CONTENTS.

THE DEPRECIATION OF THE HUMAN FACTOR.

IN connection with recent controversies relating to the trying out of men in many capacities before adopting the last resort of discharging misfits, and the cost of hiring and firing men, the least of attention seems to have been given to the "choosing" feature. It would seem that the advocates of certain systems of handling help are going so far as to devise plans of entirely doing away with the rule of the survival of the fittest.

The choosing of men whose natural tendencies make them more suitable for certain kinds of physical and mental activity has recently been declared to be an extremely simple matter based upon an exact science. Whatever may be the methods adopted for bettering the help it is assuredly much easier to improve upon a good thing than to make an efficient man out of one who has no natural bent in the desired direction. In a recent visit to one of the largest vehicle factories in Canada, we noticed a caretaker who was so corpulent as to be unable to bend over to pick up articles from the floor. Again one of the best salesmen window-dressers of our acquaintance was, once discharged after many trials, from a machine shop as being an absolute misfit.

It is reasonable to suppose that good or bad tendencies become part of one's physical as well as one's mental make-up and that they are represented in the face, actions, handwriting and in other ways to those versed in the science of character reading by unmistakable signs. It is a fact that the applicant does not always know his own best accomplishments and is often forceful in declaring what he would like to do rather than what he can do.

Whether credence is given to the scientific side of this part of the work or not, it is certain that the choosing of help is work that is worthy of the shrewdest judgment and long experience, and is no job to be entrusted to the office boy or his equivalent. One manager, to our knowledge, has accomplished much by encouraging the gateman of the employment office to take up this study so that only suitable applicants are sent on to the department heads. The figures given as to the cost of training an average applicant are somewhat alarming. In the same proportion, the cost of trying out a misfit would pay for a very large amount of prevention in the way of study on the part of the man who chooses the help.

IT is a perilous business—this ready condemnation of other people, and invariably indicates tactlessness, stupidity and gross ignorance. In its own little world, it however betokens smartness.

* * *

"As a keeper of the peace international trades-unionism has been a failure," says a contemporary. As far as keeping the peace is concerned everything has failed, but at least nobody can say that trades-unionism caused the war.

* * *

Industrial peace prevails in Canada at the present time, only one conciliation board having been constituted lately, to deal with a dispute between the city of Edmonton and its electrical employees, Judge Hyndmas is chairman.

* * *

Nobody knows what this war will cost Canada, but everybody, like the Reeve of Stayner, expects that it will cost a good deal. The Orillia Packet reports that the Reeve of Stayner complained at the Simcoe County Council that "this thing has cost me ten dollars already, and may cost me ten more before it is over."

* * *

HOUSE rents in our principal Canadian cities are, generally speaking, less now than they were a few months ago, but so is the capacity to pay them. The reduction exceptions are to be found among corporations who among other activities administer properties, estates, etc. Whatever may have been the cause for dubbing Toronto with the somewhat ignominious title of "hog town," there is ample evidence that some types of landlordism at this crucial time are no mean exponents of its altogether appropriateness.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00
Hamilton, No. 1	18 00	17 00
Hamilton, No. 2	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 9 00
Copper, crucible	10 00	10 00
Copper, unch-bled, heavy	9 50	10 00
Copper wire, unch-bled	9 50	10 00
No. 1 machine compos'n	8 50	9 00
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	4 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload	$14 25	14 25
Electrolytic copper	14 25	14 00
Castings copper	14 00	13 75
Spelter	6 25	6 25
Tin	37 00	36 00
Lead	4 75	5 00
Antimony	18 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.64
Linseed oil, raw, single bbls.	0.64
Linseed oil, boiled, sinble bbls.	0.67
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 08
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 18, 1915.—There seems to be a better tone generally throughout the iron and steel markets. With the opening of the new year, business was dull from the holiday reaction, but it has been gradually growing livelier and improving in all branches. The present increase in business is tending to bring matters, in some lines, up to normal. In the United States the outlook in the steel industry is improving. Pig iron and foundry supplies are, however, rather quiet. The machine tool business is also quiet and appearances are that they will remain so for some time yet. The Canadian railways still report a shortage in freight movements.

The manufacture of shells in Canada has become more and more prominent of late because of the extensive orders placed. The steel companies have made special dies, and many shops have either increased their equipment or rearranged that existing, so as to further compass economical production. Many plants have had designed special machines to handle expeditiously several of the subsidiary operations.

The Steel Market.

Improvement in nearly all lines is the report of the steel industry. The most encouragement has come from the United States centres. Railway corporations are entering the market for steel products very freely, there being huge orders on the books of the various car shops at present. Locomotives are in demand also. Recently the Pennsylvania Railway placed on order for 175,000 tons of steel rails, which is quite up to their normal demand. Evidently these large corporations have confidence in the outlook for business in 1915. Canadian steel companies report business on the increase, and also that the number of inquiries show a like development. In the course of the next two months the Algoma Steel Corporation expect to commence operations. Structural sections are not moving very freely, but this is about the only department of the steel trade that is dull. The improvement everywhere is general, and apparently more or less permanent.

Pig Iron.

The pig iron and iron ore market con-

tinue dull, importation of either having practically ceased.

Machine Tools and Supplies.

The machine tool business has been stimulated more or less by the orders placed for the manufacture of shells. Supplies have been similarly affected. General conditions are, however, rather dull, although not by any means as quiet as anticipated. Sales for the most part are for one or two tools at a time. Supplies have more than held their own ever since the orders for shells were placed.

Metals.*

Many interesting features in the metal markets have presented themselves during the week. In spite of pending investigation into the matter of searching American ships for contraband, the price of copper, one of the principal items of the controversy, remains about the same, there being a small advance recorded. The inference to be drawn is that the copper magnates in America do not anticipate any further trouble. If the shipments of copper fell off, the accumulation in the United States would immediately cause the price to tumble.

Spelter is not undergoing much change at present, and the price remains at the same level. Tin is strong, and although no price change has taken place, the tendency is for it to stiffen considerably.

Lead is somewhat duller than the other metals. The price has sagged a little, due largely to the fact that the usual industries which consume the most lead in times of peace are not now operating to full capacity. The uses for ammunition are not sufficiently great to make up for the lack of consumption, so the supply is in excess of the demand.

Aluminum is quiet. Antimony is now very scarce on this continent, and the price is high. At the present time supplies of antimony from England or France are practically unobtainable, the allies requiring all of it for munitions of war. Russia has evidently contracted for all the supplies from China and Japan.

*British advices just received state that copper jumped up 20 shillings per ton to-day.

Toronto, Ont., Jan. 19, 1915.—Industrial conditions are pretty much the same as they were last week, trade not having developed any marked activity since the beginning of the year. At this period business is generally quiet, only this year it is rather more so than usual. Manufacturing establishments, except those engaged on war office orders, are quiet, consequently their requirements for materials are considerably reduced. The former on this account have to exercise due economy in order to conserve their resources. The uncertainty of the outlook for the immediate future makes this more or less imperative, but in the long run the effect will be beneficial. On the other hand, factories producing war equipment are working to capacity, and are likely to continue so for some time to come.

The need for increased revenue to meet the heavy demands on the Dominion Treasury for outfitting the overseas contingents has been the cause of some speculation as to the means to be employed for meeting this condition. It is rumored that there will be a revision in the customs tariff, but no information of an official nature is available. It is, however, having a rather unsettling effect in business circles, although contracts are as a rule being made subject to tariff changes. The latter will, therefore, in a measure, be anticipated.

Officials of the Canadian railway systems are considering the question of increasing freight rates in Eastern Canada. It is reported that a petition will be submitted to the Board of Railway Commissioners to indorse the application on account of the increase in operating expenses and decrease in receipts on account of the smaller volume of business.

With regard to the iron and steel trade there is little improvement in the situation and business is dull; the same may be said of pig iron. There is a slight improvement in the demand for metals. Copper and spelter are stronger and have advanced slightly, otherwise the markets are steady. The price of scrap copper has advanced in sympathy with the copper market but business is light. There is considerable activity in machine tool circles on account of inquiries for shell machinery and some nice business has been closed.

Steel Market.

Conditions in the iron and steel trade continue dull, generally speaking, although there is some activity on account of the orders for war material, principally shells. The Nova Scotia Steel Co., it is reported, will blow in a blast furnace shortly, their open-hearth furnaces being already in operation. This company is engaged on large orders for shell forgings. The Dominion Steel Corporation is installing twelve wire-making machines. This concern has been for some time working on large orders for wire and wire products for the British Government. The order for rails booked by the Algoma Steel Co., of Sault Ste Marie, Ont., and reported in the last issue of Canadian Machinery consisted of 17,700 tons distributed among the following railroads: Pere Marquette, 8,000 tons; Michigan Central, 6,000 tons; Big Four (C.C.C. & St. L.), 1,700 tons, and 2,000 tons for the New York Central. The price for the most part is $25.50 at the mill. There is, however, little demand for steel products for ordinary purposes. The building trade is very dull and the majority of manufacturing establishments using steel products are not working at anything like the normal capacity. There has been no change in prices this week, although the market is firmer.

The market at Pittsburg is quieter, and the amount of new business has fallen off. The mills are increasing their output slightly and an optimistic feeling prevails regarding the outlook. Prices are unchanged on bars, plates and shapes.

Pig Iron.

There is nothing of interest to note in the pig iron market; business continues dull. Now that inventory-taking is over it is expected that there will be some buying, although perhaps of a light nature.

Machine Tools.

The orders for shrapnel shells are the most interesting feature in the machine tool business at present. Inquiries are constantly being received by local machinery houses for grinders, automatics, etc., for machining shells, and a number of sales have been made. There is more activity in machinery circles now than there has been for many months, almost entirely on account of the shell business, which will develop as the number of firms receiving orders increase. Apart from this particular line, however, business is quiet.

Supplies.

The market for machine shop supplies is quiet, although there is a certain amount of business passing, orders generally being for small lots. There have been no price changes except in linseed oil and turpentine which have both advanced. Oil is now 64 cents per gallon, having advanced 6 cents during the week on account of the high price of flax seed. Notwithstanding the light demand, the market is firm and may go higher in the near future. Turpentine advanced 1 cent, and is now being quoted at 64 cents a gallon. The demand is light, but the market is strong with an upward tendency. A reduction in the price of cotton waste may be expected any time now as cotton has declined in price.

Metals.

There is a slightly improved tone in the metal markets this week, although the demand is still comparatively light. Prices are holding firm generally, and in the case of copper and spelter have advanced. The copper situation is unchanged as regards exports. The market is strong and prices have advanced ¼c per pound, lake copper being now quoted at 14.25 cents per lb. The tin market is dull and featureless, but the price is firm at 36 cents per pound. The primary market for spelter is strong and the price has advanced ¼c., being now quoted at

6.25 cents per pound. The lead market continues dull and quotations unchanged at 5c per pound. The antimony market is stronger, due to increased demand, and the metal is in a strong position. The price is firm at 18c per pound, with the prospect of an advance. Aluminum is unchanged at 22c per pound.

Scrap Metals.

The continued strength in the copper market has caused an advance of ¼c per pound in the price of scrap copper. The new quotations read as follows: Light copper 9c, heavy 10c, wire 10c, No. 1 composition 9c, and turnings 8½c per pound. Brass clippings have advanced to 8c, and scrap zinc to 4c per pound. Other prices are firm and the demand generally is light.

FREDERICTON, N.B.

BUSINESS in Fredericton and vicinity continues very good, factories are running as usual and there is very little unemployment. At the present time about a dozen buildings are under way, including a concrete warehouse. It is probable that the antimony mines at Lake George, about 18 miles from the city, will soon resume operations, the price of this material having more than doubled since the outbreak of the war.

The New Brunswick Government has decided to suspend, during the war, that provision of the law prohibiting the exportation of timber for pulp purposes, cut on Crown lands of the Province, so far as relates to Great Britain. This will allow pulpwood and pit props, cut on Crown lands, to be shipped there.

New Brunswick is more fortunate than any other Province in the Dominion this year, in having universally good crops. The possibilities of sheep raising are being examined by farmers from provinces further west, the moist climate, conformation of the country, and absence of drouths, being favorable for same.

The operation of the St. John Valley Railway between Fredericton and Centreville began on December 18, and the service from Fredericton to Gagetown, it is expected, will be begun before the end of the year. Some of the most fertile farming areas will be found along the route of this new line. It is thickly settled throughout, and much traffic has been awaiting the opening.

NEWFOUNDLAND TRADE DECREASE.

THE first decrease in the total business of the Colony of Newfoundland, indicated by the annual figures of exports and imports, in more than a decade, is shown by statistics for the last fiscal year, made public a few days ago. Although exports increased by $461,654, there was a decrease in imports of $1,018,639, the total figures being: Exports, $15,134,543; imports, $15,193,726.

Shipments to the United States showed a falling off of $348,895, due to inability to market as large quantities as usual of sealskins, cod liver oil and other fisheries products. The United States was the only country from which imports were greater than in the previous year, the increase being $223,163.

The higher prices prevailing for fish brought about an addition of $547,507 to the value of exports to South America, the West Indies and Mediterranean ports.

Chiefly because of the war, all industries in the colony, except the pulp and paper mills, have diminished their output. A wider market for fish is anticipated this year, in view of the absence of French competition in the Atlantic cod fishery, resulting from the drafting of the French fishermen to serve on warships.

THE ONLY WAY.

In his recent message to Congress, President Wilson summed up his thoughts about the war in the expression of an earnest hope that the United States might have an opportunity of bringing about peace and reconciliation. The hope is worthy of his heart, but it is futile, for in this struggle the allied peoples are resolved to make a settlement with the common enemy in their own way and in their own time. Peace will not come until the foundations of a peace that will endure have been laid. This is not a war between small States which can only reap the harvest of victory or be saved from the direst consequences of defeat by the benevolent intervention of mighty neighbors. It is a war between armed arrogance and brutality and the liberties of Europe, between the claims to a military dictatorship and the claims of nationalties to the freedom of their own existence The Allies are the full-grown men of Europe who know the tremendous import of the issues and have united their powers and their resources with the one object of winning decisively. It is "a fight to the finish." There is no place for the mediator, and there will be none. This is one of the fundamental facts which must be accepted without question by the neutral world.—G. H.

CANADIAN VICKERS BUILDING SUBMARINES.

THE fact that the Canadian Vickers Co., Montreal, is engaged in constructing submarines for the British Government has been known for some time, but at the request of the Government public notification earlier has been withheld.

The censorship established by the Government has been unable to prevent the news appearing in United States papers, hence, to offset the exaggerated stories which these have published, the Department at Ottawa have given out the following statement:—

The keels for eight first-class craft of the submarine type have already been laid down by the plant, and it is expected that several will be ready by August next.

SUBMARINES IN THE WORLD'S NAVIES.

THE following is an approximate list of the number of submarines possessed by the various countries:

	Built.	Building.
Great Britain	75-80	16
Germany	35-40	12
France	70-75	12-20
United States	40	15
Italy	19	7
Japan	15	2
Denmark	8	4
Holland	10	2
Sweden	7	3
Norway	2	3
Greece	2	1
Brazil	..	3
Chili	2	..
Peru	2	..

C.P.R. BOOSTS FREIGHT RATES.

NOTICE was given by the C. P. R. at Montreal on Jan. 13, of increased freight charges for goods exported to the United States. This is in line with the recent announcement of an advance of 5 per cent. to be made. The domestic rate for grain to Boston and New York will be 18.3 and grain products 18.8 per hundred, instead of present rates, 17.5 and 18. The rate on news print paper from the mill goes from 18. to 18.9 per hundred.

The new schedule will be effective about February 15. The rates for branch lines will range from 18.8 to 19.2, according to location. Lumber rates will be raised later on the same basis of five per cent.

Capt. Gideon Adams, of the Government steamer Reserve was accidentally drowned at Prescott, Ont., on Jan. 16.

TRADE, COMMERCE, AND TRANSPORT

Embracing Statements of Manufacturing Output, Records of Imports and Exports, Company Statistics, Provincial Revenues and Trade Possibilities, Etc.

MONTREAL & SOUTHERN COUNTIES RAILWAY IN 1914.

DURING the past year, the Montreal & Southern Counties Railway made another extension to their interurban system by the electrification of nine miles of steam track, extending from their former terminus at Marieville in an easterly direction, through Rougemont—at the foot of the Rougemont Mountain—to the town of St. Cesaire. In order to conform to the new standard, this section was completely rehabilitated prior to electrification. The bonding consisted of 4/0 jumper bonds 28 in. long, of the compressed terminal type, with 2/0 cross bonds every one-quarter mile.

Overhead Construction.

The overhead construction is of the standard catenary type, consisting of 7/16 in. Siemens-Martin grade 7-strand galvanized steel messenger cable, from which is hung at intervals of 15 ft. on tangents a 4/0 B. & S. gauge American Standard grooved hard drawn trolley wire. The hangers are of the floating type, specially designed to absorb the shocks in transit, and consist of a three-bolt malleable iron Detroit type of ear to which is rivetted a ¾ in. wide, ⅛ in. thick, strap iron hanger. Forty foot 7 in. and 8 in. top cedar poles are used, spaced 150 ft. apart on tangent, and 105 ft. and 90 ft. apart on curves according to the degree of the latter. On tangent tracks a clearance of 9 ft. from center of track to centre of pole is maintained, while on curves this clearance is increased six inches.

The bracket type of construction was employed wherever possible, and consists of a 10 ft. T iron bracket attached to the pole, on which is located a malleable pin and porcelain insulator which carries the messenger wire. The messenger wire is allowed to ride free in the recess in insulator, which allows of free adjustment of line between the anchor, which anchors are located every half-mile. Cross span construction is employed throughout the yards and on several of the curves which require that type of construction. The miscellaneous overhead material was supplied by the Ohio Brass Co., and is all galvanized and sherardized. The hard-drawn trolley wire was supplied by the Standard Underground Cable Co., and the Canada Wire & Cable Co. Special steel messenger cable was supplied by the Steel Company of Canada.

The 4/0 trolley wire is supplemented along its entire length by an 816,000 C. M. aluminum feeder. This feeder gives a capacity more than enough for ordinary daily requirements, but was installed to take care of additional freight locomotives and also to handle the extra winter equipment such as sweepers and rotary plows. The feeder cable is supported on glass insulators, which in turn are carried on standard oak pins, supported on a 3½ in. x 4¼ in. x 4 ft. pine cross arm attached to pole with galvanized braces. On all curves the cross-arms are doubled and malleable iron pins are used instead of oak.

The feeder is tapped to the trolley every quarter-mile, and at each of these points Garton-Daniel lightning arresters of the 750 V type are installed. The feeder taps consist of 2/0 standard weather proof wire terminating in a feeder ear attached to the trolley and a 4-bolt aluminum clamp attached to the feeder. All aluminum feeder and clamps were supplied by the Northern Aluminum Co. The telephone despatching system already in use on the road, consisting of the Northern Electric & Mfg. Co. selector type, was extended from Marieville to St. Cesaire.

Transmission Line.

The electrification of this additional stretch of line necessitated the building of another sub-station, which was located at Rougemont. Moreover, as the Montreal Light, Heat & Power Co. did not operate in this vicinity, it was necessary for the Montreal & Southern Counties Railway to construct a private transmission line from the hydro-electric plant of the Montreal Light, Heat & Power Co. located on the Richelieu River to the proposed sub-station, a distance of 12 miles.

This transmission line is carried across country from the hydro-electric plant to where it intersects the Montreal & Southern Counties right-of-way, just east of the station at Richelieu, and from that point to Marieville it is carried along this right-of-way on a separate pole line. At Marieville, the separate pole line is disposed of, and the transmission line is carried on the top of the bracket poles.

The standard construction adopted for this transmission line consisted of 3¾ in. x 5 in. x 5 ft. yellow pine cross-arms spaced 4 ft. C.C., securely bolted to pole with ⅝ in. x 14 in. galvanized machine bolts, to which are bolted 2½ in. x 2½ in. x ¼ in. angle braces. The insulators are of the Locke No. 311 type supported on Locke No. 22 pin with porcelain base. These insulators are placed 4 ft. C.C. On the upper cross-arm is carried one phase and the ground wire, while on the lower cross-arm is carried the remaining two phases. No. 4 B. & S. guage hard-drawn copper wire is used for transmission, while No. 8 B.W.G. galvanized iron wire is used as ground wire. This ground wire is grounded every fifth pole. The power as received from the Montreal Light, Heat & Power Co. consists of 3-phase, 63 cycle, alternating current at 25,000 volts.

Sub-station.

The sub-station constructed at Rougemont is a concrete, steel and brick building 38 ft. x 44 ft. and 17 ft. 6 in. high, with a pent house 8 ft. x 15 ft 6 in. built as a second storey to allow for the entrance of the high tension wires. This building was constructed by A. F. Byers & Co., Montreal.

The electrical equipment of this substation was supplied by the Canadian General Electric Co., and consists of a 450 h.p. 3 phase 63 cycle, 2,300 volt, 10 pole induction motor direct connected to a 300 k.w., 600 volt, compound wound, direct current, interpole generator. Power is supplied to this set from 3 150 k.v.a. delta connected, oil insulated, self-cooled transformers, with primary taps for 25,000 v, 23,000 v, 21,000 v, 19,000 v, and 2,300 volts secondary.

The remainder of the apparatus consists of an A.C. and D.C. switchboard.

2—2,200-100 volt, 50 watt, 60 cycle, potential transformers.

3 sets of S.P.S.T. 35,000 volt, 300 amp. front connected disconnecting switches.

1 set 25,000 volt, 200 amp. choke coils.

1—T.P.S.T. 45,000 volt, 300 amp. K21 automatic oil switch.

1—3-phase, delta aluminum sell lightning arrester for use on 25,000 volt circuit.

This station was put in operation during the month of June, and has taken care of the service without interruption up to the present time.

Rolling Stock.

At the beginning of the year 1914, an order was placed with the National Steel Car Co. for ten new cars, in order to take care of the additional traffic which it was evident the company would be called upon to handle, due partly to the extending of their service, and partly

to the ever increasing business as people along the line become educated in the uses of an interurban system and realize the advantages it holds for them.

This order consisted of 6 motor cars, 2 trailers and 2 baggage and express cars. The motor cars and trailers are 54 ft. 6 in. long, completely equipped with toilets and water-cooler for an interurban service. The baggage and express cars are 49 ft. 4 in. long and equipped with double-end control. The electrical equipment of all cars consists of Westinghouse 306 interpole motors with H.L. multiple unit control, and the air brake equipment of Westinghouse A. M. M. type with train line for the operation of multiple units. The Westinghouse latest type of synchronizing system is used in the opening of compressor switches so that all compressors in train are cut in simultaneously. The equipment has been in operation now for five months, and is all that could be desired in an electric car.

New Extension.

While electrification of the line between Marieville and St. Cesaire was in progress, the Montreal & Southern Counties Railway had their engineers in the field surveying a direct route from St. Cesaire to Granby, a distance of 16½ miles. This line as finally located passes through the village of Abbotsford, noted as a fruit and dairy centre, and thence to Granby, a town with a population of about 6,000 people.

The first work on this new extension was commenced during the winter of 1913, when a contract was let to Ross & McCombe for the construction of two piers and two abutments in the Yamaska River, containing 1,600 cubic yards of concrete. The superstructure is of the deck plate girder type, consisting of three 80-ft. spans, with timber trestle approaches on both sides. The steel for this bridge was furnished and erected by the Hamilton Bridge Co.

The bridge was completed in the spring of 1914, at which time a contract was let to Grant, Campbell & Co. for all grading and timber work, and the laying of steel. Work on this contract was commenced on May 25, and sufficient force was employed to have the road complete and ready for operation by October 15. On August 5, however, all construction work was suspended, due to the effect of the European war on the money market, leaving the entire line practically graded and track already laid within the city limits of Granby.

In accordance with the agreement between the corporation of Granby and the Montreal & Southern Counties Railway Company, steel poles set in concrete were installed throughout the city, direct suspension cross-span construction to be used within the city limits. On the main line between St. Cesaire and Granby, standard catenary construction will be employed similar to that in vogue on the rest of the line.

Another sub-station is to be built, just outside the city limits of Granby, in conjunction with a car barn capable of storing six cars. The present equipment of the sub-station will be one 400 k.w. motor-generator set with all necessary auxiliary equipment, but sufficient space will be provided for an additional unit of like capacity.

U.S. PIPE, TUBE AND SHEET PRODUCTS.

DURING 1913, the United States production of wrought iron, steel and cast iron pipe, boiler and seamless drawn tubes, and galvanized sheets was as follows, according to special statistical bulletin No. 10, recently issued by the American Iron and Steel Institute.

W.I. and Steel Pipe and Boiler Tubes.

The production of wrought iron and steel pipe and boiler tubes in the United States in 1913 amounted to approximately 2,245,532 gross tons, of which about 276,067 tons were iron and about 1,969,465 tons steel. Of the total 830,472 tons was black standard pipe, of which 120,619 tons were iron and 709,853 tons steel; 266,940 tons were galvanized pipe, of which 25,323 tons were iron and 241,617 tons steel; 841,089 tons were oil country goods, of which 84,778 tons were iron and 756,311 tons steel; 179,211 tons were O. D. and miscellaneous pipe, of which 2,159 tons were iron and 177,052 tons steel; and 127,820 tons were boiler tubes, of which 43,188 tons were iron and 84,632 tons steel.

Of the active plants, 2 were located in New York, 15 in Pennsylvania, 2 in West Virginia, 5 in Ohio, and 1 in Illinois. It was necessary to estimate the output of two plants. Four plants were idle during the whole of 1913—2 in Pennsylvania and 2 in Illinois. There were 19 plants in 5 States which made iron or steel black standard pipe, of which 1 was located in New York, 10 in Pennsylvania, 2 in West Virginia, 5 in Ohio, and 1 in Illinois. Ten plants made boiler tubes, of which 1 was located in New York and 9 were in Pennsylvania.

The production of hot-finished and cold-drawn seamless steel tubes in the United States in 1913 amounted to approximately 108,567 gross tons, of which about 42,740 tons were hot-finished tubes and about 65,827 tons cold-drawn tubes. It was necessary to estimate the output of a few plants. Of the active plants in 1913, 6 were located in Pennsylvania, 1 in Ohio, 1 in Michigan, and 1 in Wisconsin.

Iron and Steel Galvanized Sheets.

The total production in the United States in 1913 of iron and steel galvanized sheets and of articles which were formed or stamped from iron or steel black plates or black sheets and galvanized after the completion of the forming or stamping process amounted to about 1,961,080,107 lbs. The total production of galvanized sheets alone amounted to 1,811,752,565 lbs., while the production of articles formed or stamped from iron or steel black plates or black sheets and galvanized after the completion of the forming or stamping process amounted to about 149,327,542 lbs.

There were 92 plants which made iron or steel galvanized sheets or which stamped or formed articles from iron or steel black plates or black sheets and galvanized them after completing the forming or stamping process. Six of these were located in Massachusetts, 1 in Rhode Island, 2 in Connecticut, 7 in New York, 5 in New Jersey, 9 in Pennsylvania, 1 in Delaware, 3 in West Virginia, 2 in Kentucky, 2 in Georgia, 29 in Ohio, 4 in Indiana, 6 in Illinois, 4 in Michigan, 4 in Wisconsin, 4 in Missouri, and 3 in Iowa.

There were 61 plants in 1913 which manufactured or stamped black plates or black sheets into various forms, and galvanized these forms after the completion of the forming or stamping process. Six of these plants were located in Massachusetts, 1 in Rhode Island, 2 in Connecticut, 6 in New York, 5 in New Jersey, 6 in Pennsylvania, 2 in West Virginia, 2 in Georgia, 10 in Ohio, 1 in Indiana, 5 in Illinois, 4 in Michigan, 4 in Wisconsin, 4 in Missouri and 3 in Iowa.

Cast-Iron Pipe and Fittings.

The production in the United States in 1913 of cast iron gas and water, soil and plumbers' pipe and fittings amounted to 1,266,245 net tons, of which 1,002,289 tons were gas and water pipe and fittings and 263,956 tons soil and plumbers' pipe and fittings. The production of gas and water pipe includes 46,831 tons of fittings, while the production of soil and plumbers' pipe includes 68,925 tons of fittings and 7,727 tons of culvert pipe. Of the 67 active plants, 1 was located in Massachusetts, 6 in New York, 9 in New Jersey, 9 in Pennsylvania, 1 in Maryland, 3 in Virginia, 1 in Kentucky, 3 in Tennessee, 2 in Georgia, 15 in Alabama, 1 in North Carolina, 9 in Ohio, 1 in Indiana, 3 in Illinois, and 1 each in Michigan, Colorado and Oregon.

Thirty-four plants reported the manufacture of cast iron gas and water pipe and fittings in 1913, of which 1 was located in Massachusetts, 2 in New York, 5 in New Jersey, 5 in Pennsylvania, 1 in Maryland, 3 in Virginia, 1 in Kentucky, 1 in Tennessee, 1 in Georgia, 5 in Alabama, 6 in Ohio, 1 in Michigan, 1 in

Colorado, and 1 in Oregon. Four of the plants made cast iron soil and plumbers' pipe and fittings as well as gas and water pipe. There were 37 plants which made soil or plumbers' pipe or cast-iron culvert pipe in 1913, of which 5 were located in New York, 5 in New Jersey, 4 in Pennsylvania, 1 in Maryland, 2 in Tennessee, 1 in Georgia, 11 in Alabama, 1 in North Carolina, 3 in Ohio, 1 in Indiana, and 3 in Illinois. Four of the plants also made gas and water pipe.

OPENING FOR EXPORT TO AUSTRALIA.

AN Australian firm writes stating that they have been closely and extensively identified with a general lighting and heating business in gas, electric and oil of all desriptions through the Commonwealth of Australia and New Zealand. Their principal supplies have hitherto been obtained from Germany and Austria, and in view of recent events, the directors have decided in future to confine the operations of the company to goods manufactured in the Empire. They are therefore desirous of immediately getting in touch with manufacturers in the above lines. In addition to the above they state that they are already identified with the general hardware trade and are open to negotiations for agencies of special lines contingent to that business especially from manufacturers of engineering and similar lines. It is suggested that any firms who communicate should send full catalogues with complete export price lists and details of what is offered.

It is probable that one of the directors of the firm will next year visit the Panama Exposition and at the same time take a tour through Canada which would give the opportunity of personally interviewing firms with whom communication has occurred. They consider the present time an excellent opportunity for Canadian manufacturers in Australia. Canadian firms desiring business of this character are asked to communicate with D. H. Ross, Canadian Trade Commissioner, Stock Exchange Buildings, Melbourne, and meantime they can obtain the address of the firm named on application to the Department of Trade and Commerce, Ottawa.

Kate Gleason, secretary-treasurer of the Gleason Works, Rochester, N.Y., has won the distinction of being the first woman admitted to the membership of the American Society of Mechanical Engineers. Miss Gleason took a mechanical engineering course in Cornell University and received practical training at the plant of her father, William Gleason, in building, estimating and selling machinery. At present she is reorganizing the Ingle Machine Co. Her specialty is designing gearing and estimating on same.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

St. Catharines, Ont.—The Reo Motor Car Co. has received an order for shrapnel shells.

Transcona, Man.—It is announced that the G. T. P. are working a large order for shells at the shops here.

Craik, Sask.—G. Carlson has submitted a proposition to the council for installing an electric lighting plant.

St. Mary's, Ont.—The council are considering the purchase of a gasoline engine and a pump with a capacity of 880 gallons per minute.

Montreal, Que.—It is reported that President N. Curry, of the Canadian Car & Foundry Co., has secured some large contracts for war material from the British Government.

The Holden-Morgan Co., Toronto, have moved into larger premises at 579 to 585 Richmond street west, and are installing additional equipment in order to meet all the demand along the lines of special machine work.

Cobalt, Ont.—Fire starting shortly after five o'clock last Thursday in the boiler house of the Meteor Mine, which adjoins the McKinley Darragh Savage property, completely destroyed the power plant of the mine, besides the mine blacksmith shop.

Kingston, Ont.—The district around the village of Parham on the C. P. R. will secure electrical power. Frame Bros., who own a lumber mill using fifty horse-power supplied by water from a 28-foot fall on Eagle Creek, are having an expert from Toronto look over their property.

Fredericton, N.B.—The New Brunswick Department of Agriculture has purchased the first pulverizing plant for grinding lime rock for use as fertilizer that has been brought into Canada. Hon. James A. Murray, Minister of Agriculture, announced that the order for the plant had been placed with a manufacturer in the United States, the cost being approximately $2,000.

Vancouver, B.C.—In consideration of the City of North Vancouver granting the company free water and exemption from taxation for a period of ten years, the Dominion Shipbuilding, Engineering and Drydock Co., which has already progressed considerably with its new works beyond Moodyville, is prepared to guarantee the employment during the first year of 250 men, during the second year 300 men, and during the third year 400 men.

Cobalt, Ont—The actual construction of the Tough Oakes mill is now almost complete, and nearly all the heavy machinery is on the ground and in place. The mill is scheduled to be running at the end of March, and the construction is fully two-weeks ahead of expectations. As the flow-sheet of the mill is necessarily somewhat different from that of any other in the north country, it is difficult to estimate its capacity, but it will probably be able to treat 150 tons a day.

Montreal, Que.—It is understood that the annual meeting of the Hollinger Company will be held here about February 2. About that time the company will have eighty stamps in operation, or twice the number at the same time a year ago. A further twenty stamps will be delivered in the course of next month. These latter will be for the Acme property. A new electric hoist has been ordered for the Hollinger, where a larger tonnage will be drawn for the mill once the eighty stamps are crushing to their capacity. In due course the one hundred stamps will crush 30,000 tons of ore in each four weekly periods, representing a gold content of about $375,000, or nearly $5,000,000 yearly.

Calgary, Alta.—C. H. Mitchell, consulting engineer, of Toronto, has reported that it is economically feasible to so regulate the flow of the Bow River, by means of storage works in its upper waters, as to warrant the development at six power sites of over 45,000 continuous 24-hour w.h.p., all within 50 miles of the City of Calgary. Calgary Power Co. has two developments on that river, one at Horse Shoe Falls and the other at the Kananaskis Falls, a little further up stream. The company claims to be able to deliver 26,000 continuous horse-power for nine or ten months in the year and 12,000 horse-power when the river is at its minimum flow. According, however, to the report issued by the Department of the Interior, the Bow River has a capacity of 45,000 continuous 24-hour w.h.p.

Electrical

Mount Forest, Ont.—The hydro-electric by-law was carried here by a substantial majority.

Durham, Ont.—The hydro-electric by-law was carried. This town will be on the Eugenia Falls system.

Shelburne, Ont. — The ratepayers voted in favor of a distribution system for hydro-electric power to cost $15,000.

Dundalk, Ont.—The ratepayers carried a by-law recently to spend $5,000 on a sub-station and equipment for hydro-electric power.

Kingston, Ont.—Sir Adam Beck will again be notified by the Kingston Utilities Commission that Kingston is waiting for cheap power. This was decided upon when the commission held its first meeting of the year last Monday.

Wallaceburg, Ont. — The Canadian Westinghouse Co. is at present installing equipment in the sub-station on King Street. Later on the transformers will be installed and hydro current will be ready for use probably early next month.

Newmarket, Ont.—With hydro power beaten, the Fire and Light Committee of the Town Council have submitted a bill to the Council for a by-law to be submitted to the electorate authorizing the expenditure of $15,000 on poles, wire, and equipment.

Weston, Ont.—The town hydro rates were slightly reduced at the meeting of the Weston Water, Power, and Light Commission on January 13, when a new schedule was submitted by W. W. Pope, secretary of the Ontario Commission, and was accepted. The reduction is from 4 cents to 3 cents per 100 square feet of floor space. The minimum floor space charge is 1,000 square feet and the maximum is 3,000.

Montreal, Que.—There is a possibility that June next will see St. Catherine Street, from Atwater to Papineau Avenue and Bleury Street from Craig to Sherbrooke, illuminated with the new lamps served by underground cables for which citizens have so long waited. The conduits have been in place for over a year, and the Montreal Public Service Corporation and the Montreal Light, Heat and Power Co. are well advanced with the new underground connections necessary.

General Industrial

Montreal, Que.—The St. Lawrence Tanning Co. are contemplating building a new tannery.

Brantford, Ont.—The Brantford Scale Co. will build a factory at a cost of $20,000. J. L. Howard is the manager.

Montreal, Que.—The Canada Bread Co. are building an extension to their bakery. Machinery will be required.

Hamilton, Ont.—Fire did damage to the extent of $1,000 to the Judd Soap Works, 101 Bay Street, on January 11.

MacLeod, Alta.—The MacLean Flour Mills were recently destroyed by fire. The loss is estimated at $30,000, part of which is covered by insurance. The mill may be rebuilt.

Fort William, Ont.—The Ogilvie Flour Mills Co., will build an addition to their elevator which will increase the storage capacity by 750,000 bushels, making a total of two million bushes.

Moose Jaw, Sask.—Negotiations are proceeding for the reorganization of the Moose Jaw Flour Mills, Ltd., and a prospectus for the benefit of intending shareholders will be issued in a few days.

Vancouver, B.C.—The Laminated Materials Co., with head offices in Boston, Mass., has leased the building on the Fraser River owned by the Dominion Match Co., and their machines are on the way to Vancouver.

Chambly, Que.—The Chambly Manufacturers, Ltd., makers of leather goods, have started operations at their new plant at Chambly, Canton. The company has a capital of $100,000, and the building, which is 200 x 100 feet and three storeys high, cost $50,000.

Moose Jaw, Sask.—Dr. Jackson, the inventor of "Roman" meal, has, as a result of his visit to Moose Jaw, placed this city upon his list of suitable places wherein to locate a mill for the manufacture of the meal. Already the doctor has mills running in Tacoma, Duluth, St. Louis, Toronto.

Beamsville, Ont.—Messrs. Frampton & Stewart waited upon the council on Jan. 11 with reference to the erection of a jam factory. Mr. Stewart said that the company would like a loan of $10,000, for which they would pay interest, a fixed assessment, and help in securing a good site at a nominal cost. They would also want a supply of water.

Raymond, Alta.—A telegram from Jesse Knight, president of the Knight Sugar Co., received on January 14, by Raymond Knight, stated that the directors of the company at a meeting in Salt Lake had definitely decided to move the factory from Raymond to Layton, Utah. There is only one way now to hold the sugar industry in Alberta, that is to buy the plant with Canadian capital. Such a scheme will likely be launched immediately.

Municipal

Toronto, Ont.—The township of Lambton Park are proposing to install a waterworks system.

Calgary, Alta.—Extensions to the fire alarm system have been recommended by Fire Chief Smart.

Calgary, Alta.—Extensions to the gas pipe line are contemplated. City Engineer Craig has the work in hand.

Guelph, Ont.—The tenders for improvements to the gas plant have been opened and considered, but no award has yet been made.

Vancouver, B.C.—The municipality of South Vancouver contemplate installing a new 12-in. water main, also valves and hydrants.

Ottawa, Ont.—The Board of Control has ordered two fire engines from the American La France Co. The price for the two engines is $22,275.

Little Current, Ont.—A by-law will be voted on by the ratepayers on Jan. 25 to authorize raising $8,000 for completing the electric light plant.

Halifax, N.S.—The City Council have under consideration the formation of a factory district along the lines suggested by the City Improvement League some years ago.

Humboldt, Sask.—The ratepayers will vote on a by-law on January 26 to sanction the expenditure of $3,164 on completing the construction of the electric light system.

Brantford, Ont.—Chipman & Power, consulting engineers of Toronto, have the work in hand for the proposed extensions to the waterworks system, for which a by-law was recently passed.

Tenders

Calgary, Alta.—Tenders will be received up to February 12, 1915, for the furnishing and erecting of steel superstructure for Louise Bridge at 9th St. West. Plans, specifications and information may be obtained from the city engineer's office, upon making a deposit of $5.

Toronto, Ont.—Tenders will be received at this department until Monday, February 1, 1915, for the electric fixtures required for new Government House, Rosedale, Toronto. Plans and specifications can be seen at this department. H. F. MacNaughten, secretary, Public Works Department.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, City Hall, up to Tuesday, February 2, 1915, for the supply of cast iron special castings. Specifications and tender form for the foregoing may be obtained upon application at Room 12, purchasing and accounting section, of the Department of Works, City Hall.

Torotno, Ont.—Tenders will be received up to Tuesday, February 2, 1915, for the supply and delivery to the Street Cleaning Department of 100 (more or less) loose paper can receptacles, as may be required. Specifications may be seen and form of tender obtained, together with all information relative thereto, at the office of the Street Cleaning Department, City Hall, Toronto.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, up to Tuesday, February 16, 1915, for supply and installation of furnaces and appurtenances for refuse incinerating plant. Specifications and tender form for the foregoing may be obtained upon application at the office of the Street Commissioner, Department of Street Cleaning, City Hall, Toronto.

Railways—Bridges

Transcona, Manitoba.—A meeting of Transcona property owners was held recently in the office of Moore & Sutherland, barristers, Winnipeg. The object of the gathering was to secure encouragement for the location of shops at Transcona for the Hudson Bay Railway.

Vancouver, B.C.—With the laying down of about forty miles of steel in the neighborhood of Ashcroft, B.C., the C. N. R. will link up with the Pacific Coast, and to follow the opening of the Panama Canal, business people of the East look for a large development in trade generally.

Ottawa, Ont.—The Entwistle and Alberta Southern Railway Co., is applying to Parliament for incorporation to build from Entwistle on the G. T. P., 55 miles south to the Saskatchewan River. The Southern Central Pacific Railway Co. is asking for an extension of time to build its railway from Vancouver to Hudson Bay.

New Incorporations

The Regina Mining Co. has increased the capital stock from $50,000 to $200,000.

The American Madoc Mining Co., incorporated under the laws of New Jersey, has been authorized to carry on business in the Province of Ontario with a capital not exceeding $200,000.

Vitrified Clays, Ltd., incorporated in Alberta, has been authorized to conduct business in Ontario with a capital not to exceed $40,000. Frank B. Goodman, of Toronto, has been appointed attorney.

H. & H. Box Co. has been incorporated at Toronto, Ont., with a capital of $100,000 to manufacture boxes, etc., at Pembroke, Ont. Incorporators: A. J. Thomson, W. Symon Morlock and A. Latimer, all of Toronto, Ont.

The Ideal Incinerator and Contracting Co. has been incorporated at Toronto, with a capital of $100,000, to manufacture crematories, furnaces and incinerators at Toronto. Incorporators—J. T. White, George R. Sproat and Franklin M. Metcalfe, all of Toronto.

Tho Hall Furniture Co. has been incorporated at Ottawa, Ont., with a capital of $125.000 to manufacture chairs and furniture of all kinds at Hanover, Ont. Incorporators: R. J. Ball, John Ball and M. L. Ball, all of Hanover, Ont.

Automatic Paper Box Co. has been incorporated at Ottawa, Ont., with a capital of $100.000 to manufacture boxes and other similar receptacles, at Toronto, Ont. Incorporators: H. H. Hawkins, W. Lanskaill and C. E. Lanskaill, all of Toronto, Ont.

G. M. Gest, Ltd., has been incorporated at Ottawa, Ont., with a capital of $100,000 to carry on business as electrical and mechanical contractors at Montreal, Que. Incorporators: W. R. L. Shanks, F. G. Bush and G. R. Drennan, all of Montreal, Que.

The Gulf Pulp & Lumber Co. has been incorporated at Ottawa, Ont., with a capital of $250 000 to manufacture wood and pulp at Montreal, Que. Incorporators: S. Frankland Kavanaugh, V. R. Lamontagne and F. W. Harper, all of Montreal, Que.

Manufacturing and Contracting Co. of Canada, Ltd., has been incorporated at Ottawa, Ont., with a capital of $150,000 to carry on a construction business at Toronto, Ont. Incorporators: T. A. Rowan, J. E. Jones and N. Sommerville, all of Toronto, Ont.

Munro Construction Co. has been incorporated at Ottawa, Ont,, with a capital of $50,000, to carry on business as general contractors, builders and engineers at Montreal, Que. Incorporators: T. J. Coulter, W. S. Jones and R. T. Nulin, all of Montreal, Que.

Trade Gossip

The Standard Chemical Iron and Lumber Co., of Canada, Ltd., is reducing its capital stock from $6,000,000 to $5,000,000.

The Norton Grinding Co., Worcester, Mass., have sold in Canada during the last few months twenty machines for grinding shrapnel shells.

The Nova Scotia Steel & Coal Co., New Glasgow, has placed an order in the United States for a complete equipment for making shrapnel shells.

The Fisher Motor Co., Ltd., have received an order from the Dominion Government for the manufacture of 20,000 shrapnel shells. These will be made at the Orillia factory.

The Ontario Power Co., of Niagara Falls, Ont., have given notice of a proposal to increase the capital stock from $10,000,000 to $15,000,000. A meeting will be held on Feb. 16.

A. F. Yarrow recently gave the 2,500 employees of Yarrow & Co., Scotstoun, on the Clyde, Scotland, a new ten-shilling note ($2.50) each as a gift in recognition of the energy displayed in the completion of several vessels.

Thos. Firth & Sons, Ltd., Sheffield, are supplying large quantities of light bullet-proof sheets of a special alloy steel for use on aircraft, armoured motors and other purposes to the Allied armies. The sheets have proved highly effective.

Sherbrooke, Que.—It is probable that the exportation of asbestos will be resumed on a larger scale than previous to the war. It is reported that several concerns in Australia have placed contracts for large quantities of asbestos from the Thetford Mines district.

The Algoma Steel Co. has taken orders for 17,700 tons of rails in the United States: 8,000 for the Pere Marquette, 6,000 for the Grand Trunk Railway for Michigan delivery, 1,700 for the Big Four, and 2,000 for the New York Central. All were sold at about $25.50 at mill.

Montreal, Que.—The new officers of the Board of Trade, who will be installed at the annual meeting, to be held on the afternoon of Tuesday, January 26th, are as follows:—President, George F. Benson; first vice-president, H. B. Walker; second vice-president, Zephirin Hebert; treasurer, Anson McKim.

The National Boiler Washing Co. of Montreal have opened an office at 1206 Union Trust Building, Winnipeg, Man., with T. W. Purcell in charge. F. H. Hopkins & Co. are at the same address.

Sydney, N.S.—The Broughton coal mine, owned by the Cape Breton Coal, Iron and Railway Co., which has been in operation for over a year, closed down on January 18 for an indefinite period. Manager C. J. Gall stated that this action has been made necessary owing to the financial situation due to the war.

Shell Manufacture.—Representatives of various manufacturing companies are in Ottawa this week conferring with the Government in connection with the construction of shells. These companies, the demand for whose normal output has been seriously interfered with by the war, are anxious to take advantage of a demand which promises to be fairly brisk for some time to come and to manufacture a product which can be profitably disposed of. Already a large number of manufacturing firms have put in the plant necessary for such manufacture, and it is estimated that the total output of Canadian shells will soon approximate 100,000 per day. It is expected that this will shortly be increased until 200,000 per day are being turned out for the cannon of the allies.

Cobalt Tonnage Declines.—While December was far below the previous December in tonnage of Cobalt ore shipped, it was considerably higher than the previous month. Silver is absorbed in London, no one quite knows how or for whom as little goes to China, and the demand in India is spasmodic. In the arts there is little or no demand, but the price remains steadily at about 50 cents. The Mining Corporation of Canada, from its three mines, the Townsite, the Cobalt Lake and the City of Cobalt, was by far the heaviest shipper, the McKinley Darragh figuring next on the list. There was a small consignment to the Cobalt sampling plant from an Elk Lake prospect, the first from that camp for many months. The Beaver and Timiskaming group, upon which the rich find has recently been made, showed much greater activity.

Australian Tariff Increase.—Details of the new Australian Customs tariff adopted by the Commonwealth Parliament last month have been received by the Department of Trade and Commerce, Ottawa. There has been a pretty general stiffening of the protective and revenue-producing

features of the old tariff, and a considerable trade in Canadian exports of agricultural implements. printing paper, lumber, fish in tins, motor cars and vehicle parts will be adversely affected. The Commonwealth has increased the preference to the United Kingdom on manufactured goods from 5 per cent. to 10 per cent., but this increase has been made in the main by simply raising the 5 per cent. on the general tariff upon goods imported from all other countries. Prior to the last general elections in Australia the Government promised increased protection to Australian interests, and the new tariff fulfills this pledge.

MACHINE FOR MARKING FUSE CAPS.

A SPECIAL marking machine for graduating and numbering bevel fuse caps in one operation, and fully equipped with graduating dies ready for the operator to start work, has just been put on the market by the Noble & Westbrook Mfg. Co. of Hartford, Conn. This is an addition to the company's well-known Dwight slate marker. The machine illustrated herewith is simple in construction, accurate and easy to operate, which means quite a saving when a large quantity of pieces are to be graduated, especially at this juncture, with war orders large and pressing.

The graduating die is held in a holder keyed to shaft, which as mark is made, revolves with the die, at the same time winding a spring tension which, as soon as contact with work is broken, returns work holder to its proper position to mark the next piece. The shaft runs in bronze bearings with collar adjustment, and the work is held in place relative to die by accurately cut gears. Depth of impression is provided by foot pressure through a lever and cam, which is adjustable so that it is possible to regulate the depth of impression to an hundredth part of an inch. This means that even and accurate impressions can be secured.

The machine is suitable to graduate not only fuse caps, but any bevel surface, such as micrometer collars on lathes, milling or any machine that uses these graduated collars. It can also be used to put on lettering in place of graduations on bevel surfaces, and will give excellent results. The saving of time and labor in graduating or lettering is a feature, as with one turn of the hand lever a complete mark is made and all such can be depended upon for uniformity and accuracy.

A number of these machines have already been supplied to Canadian manufacturers in connection with shrapnel shell orders now being filled. All shrapnel shells must bear the maker's name, date of manufacture, size, etc., on the side, and these impressions are made at one operation by the regular type machine. The special fuse cap marking machine is for graduating the caps to determine the exact distance for throwing and exploding the shell, etc.

FUSE CAP MARKING MACHINE.

Catalogues

J. W. Paxson Co., Philadelphia, Pa., are distributing a calendar for 1915, printed in bold type and featuring principally the "Albany" molding sand.

The Vulcanite Portland Cement Co., Philadelphia, Pa., has published in pamphlet form a reprint of the paper entitled, "Proportioning Aggregates for Portland Cement Concrete," by Albert Moyer. The paper was read before American Society for Testing Materials, the proper proportioning of materials in concrete.

Factory Appliances.—The Cleveland Wire Spring Co., Cleveland, Ohio, have sent us a copy of catalogue No. 28, describing their line of steel shop boxes, steel barrels, waste cans, steel racks, and various other steel and wire specialties of factory equipment. Each line is illustrated and accompanied by particulars and sizes. An interesting feature is that entitled "Things Your Factory Needs."

American Pulleys.—The American Pulley Co., Philadelphia, Pa., have issued a series of data sheets, held together in an attractive green binder. Each data sheet deals with some distinctive feature concerning the "American" pressed split pulleys, including results of comparative tests with diagrams and charts. A number of loose leaflets dealing with these pulleys are mailed with the data sheets.

Hydraulic Presses, made by the Mesta Machine Co., Pittsburg, Pa., are described in a bulletin recently issued. These presses are of the quick-acting steam-hydraulic type, and are designed for such operations as forging, flanging, punching and bending. The chief features of this type of press are dealt with fully, and the illustrations show a number of high capacity presses in operation.

Valves.—The Lunkenheimer Co., Cincinnati, O., is distributing the "Ferrenewo" and "Clip" valves. The former is a globe valve and the latter a gate valve. Both types are described at length, and the special features of their design are dealt with in detail. Price list and tables of leading dimensions are included, covering each size. The illustrations showing the construction of these valves are reproduced in attractive colors.

Transmission of Power by Ropes is the title of a paper read by Edwin Kenyon, of Dukinfield, near Manchester, England, before the National Association of Cotton Manufacturers at Boston, Mass. This paper, while not of particularly recent date, is none the less interesting, and contains much valuable data on the subject of rope drives. The paper deals entirely with English practice, and many interesting drives in Old Country factories and mills are illustrated. The paper contains considerable information on pulley grooves, ropes and splices, and is fully illustrated. Further information can be obtained from Jones & Glassco., engineers, Montreal, Que.

Book Reviews

Germany's Naval Pocket Book for 1915, just published, shows obvious signs of having been heavily "censored," for copies received deal only with the fleets of enemies and those of neutral powers, and say nothing of the German fleet. Not a single word is said as to the German losses, new, building, or old ships ,while all the books of other years included a

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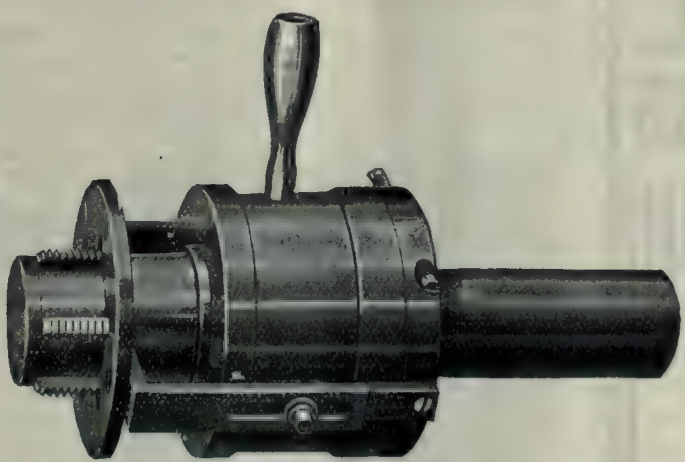

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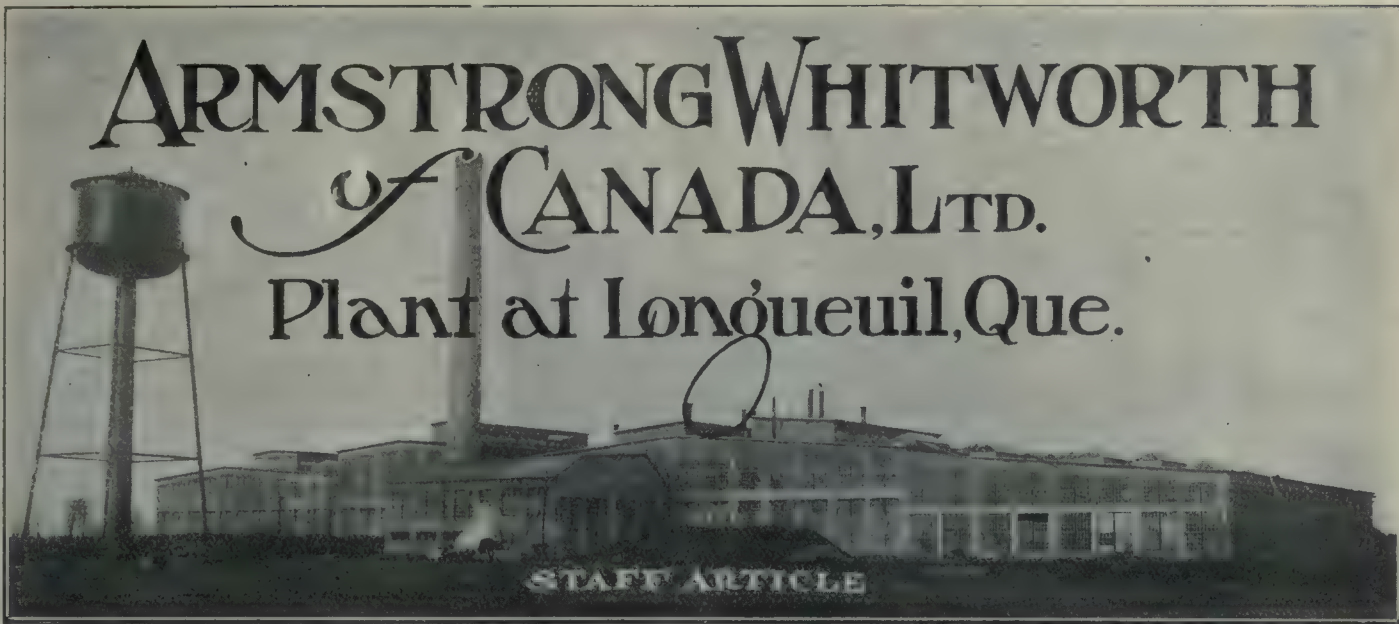
complete list, with all particulars of the German navy.

Installing Efficiency Methods, by C. E. Knoeppel; 258 pages, 10 in. by 7 in., 103 charts and diagrams; published by the Engineering Magazine, New York. Price, $3. This book is an addition to the Works Management Library, and the contents, as originally prepared, appeared in a series of articles published in the Engineering Magazine during the year 1914. In this volume, however, the matter has been much expanded and to a considerable extent recast. For the benefit of those who may have already perused these articles it may be stated that the first five chapters are new, except a list of questions in chapter 5. A chapter on auxiliary devices for the planning department and a supplementary chapter on costs have been added, while a chapter on the efficiency clearing house has been considerably enlarged. More charts and diagrams have also been introduced. In writing this book, the author has endeavored to deal with practice rather than mere definition of principles. He describes what the actual methods are that increase the efficiency of a manufacturing establishment and how they are put into a practical effect. In this respect the book differs from most other publications on the subject. The book contains 19 chapters, including an appendix on manufacturing costs, embracing a skeleton outline of a cost accounting system. The first chapter gives a hypothesis of a company in business difficulties and, in succeeding chapters, the method of procedure for placing it on a satisfactory basis is described. Each phase of the system is dealt with thoroughly and its connection with the general scheme always kept in view. The diagrams and charts, essential in work of this nature, are carefully drawn, and are of great value to a proper understanding of the text. The methods described are essentially applicable to engineering establishments, and, being based on actual practice, will be valuable to those readers interested in efficient organization and management.

Classified Advertisements



The establishment of a plant for the manufacture of crucible steel for such purposes as taps, dies, drills, etc., marks a new era in the history of Canadian industrial enterprise, and goes to show that there is not only a great opportunity to be taken advantage of, but gives expression also of unqualified confidence in the future development possibilities.

FOR the most part, the greater portion of that large amount of British capital which has been invested in Canada has been placed in purely Canadian concerns operated by Canadians. Instances are few, where propositions due entirely to British initiative, have been launched in Canada. One of these however, is the new crucible steel plant of the Armstrong-Whitworth Co. at Longueuil, P.Q., which is to be the Canadian branch of the parent factories in Manchester and Newcastle, England. The plans were drawn in England but the construction of the buildings was entrusted to the well-known contracting firm of E. G. M. Cape & Co., of Montreal. M. J. Butler, C.M.G., took care of the machine installation and the various engineering problems.

Plant Site.

Longueuil was chosen as the site of the new plant for various reasons, chief among which, were the facts that sufficient land could be obtained, not only for present requirements, but plenty for all future needs; that the town is ideally situated for the accommodation of all the employees that the company will require; and that the shipping facilities are good. Again, the head office of the company in Canada is located in Montreal and thus the plant can at all times be in close touch with its head office. Montreal, too, being an ocean port and the commercial capital of the Dominion, makes the plant site choice an ideal one.

The property of the company extends from the river front back to and beyond the line of the Quebec, Montreal, & Southern Railway, which is a steam road forming part of the Delaware and Hudson system, and has a frontage on the river of about a quarter of a mile. The town of Longueuil is located on the south shore of the River St. Lawrence, almost directly across from the town of Maisonneuve, the eastern suburb of Montreal, and the company's land consisting of about two hundred and fifty acres, is located on the eastern boundary.

Lines of Product.

The manufacturing output of the company will consist of high speed and crucible steels and high speed steel products, such as taps, dies, punches, mining drills, milling cutters, twist drills, reamers, and tool steel rolled and hammered in its various sizes and sections. The output will thus be of such a nature as to lend itself readily to motor truck transportation, and it is planned to maintain such a service between the works and the city of Montreal. There are two ways open to these vehicles of reaching the city, namely, by the excellent ferry service of the Canada Steamship Lines, and via the Grand Trunk Victoria Jubilee Bridge. For the period during the winter when the river is frozen there is, of course, only the latter way of reaching the city.

M. J. BUTLER, C.M.G.
Managing Director Armstrong, Whitworth of Canada, Ltd.

Factory Buildings.

The buildings are entirely of reinforced concrete with steel frame work supporting the crane runways and the roof, while the side walls are practically huge windows. The main building is in the shape of an L. The present structures are built with the idea of future extensions, the east wall being of a temporary nature and consisting almost entirely of glass. Because of the fact that these future extensions were kept in mind so carefully when the plant was designed, the present length of the building is really the future width, and this is impressed on one the moment the building is entered. The bays all run in the short direction as also do the monitors, which are located over each main bay. In these monitors are also installed many glass ventilators. All of the steel was obtained from the Dominion Bridge Co., of Lachine.

It was decided to perform one operation only, or a certain series of dependent operations in each bay and the whole structure is designed to that end. There is a traveling crane in each main bay, the runway in each case extending throughout the whole length. In the business of manufacture, furnaces and ovens, enter largely into the process, therefore it was deemed necessary to place a small bay some fifteen or twenty feet wide between each main bay. The furnaces have been so arranged that their chimneys will all lead up through the narrow bays thus allowing the full floor space in the main bays to be served by the traveling cranes. The main mill is 550 feet long, and the length of the mill for part of the distance is 100 feet and, for the remainder, 175 feet.

All the raw material is delivered to the plant by rail over the Q.M. & S. Railway. Two tracks enter the shop from the north and these run the whole width of the steel manufacturing shop. Thus material can be delivered to any bay desired. Further, material can be moved from one department to another by means of these two tracks as the plant is equipped with trucks to run on these tracks. When delivered to any bay, the material is handled by the traveling cranes, making shop transportation of material quite a simple matter.

PARTY LEAVING MONTREAL STATION TO TAKE PART IN PLANT OPENING.

Mixing Room—Main Bay I.

The mixing room, which really consists of the most northern bay of the shop, is 50 feet wide, and is equipped with a 5-ton crane. In this bay the alloys are received, and also the ore of the base metals. The alloys are received in the refined state. Here the two are mixed according to specifications received from the confines of the chemical department, where there are being constantly pursued experiments of various natures. After the alloys and base metals have been mixed, they pass on to the next department, which is the coke oven bay. Between the two main bays, however, there is located a minor bay some fifteen feet wide. The coke ovens are so arranged that their chimneys are in the small bay and they have a direct passage to the roof.

Coke Oven Bay—Main Bay II.

In the coke oven bay there are installed two sets of furnaces each having three holes. The bay is 50 feet wide and is equipped with a five-ton electric traveling crane. The two furnaces are similar and are of a patented design which has been improved and perfected in the Manchester works of the firm. The basic metals and ore after leaving the mixing room arrive at the coke oven bay on trucks which roll on the tracks. The mixed material is placed in crucibles and these crucibles are then placed in the coke ovens. Each hole of the coke ovens is capable of holding four pots or crucibles. The capacity of the two coke ovens at one time is thus twenty-four pots, and the fires are some six feet below the level of the floor of the shop. The crucibles are lowered into the holes or pits which are three feet eight inches deep.

Crucible Handling.

The crucibles are handled entirely by means of tongs which require some expert work on the part of the men, the pots being lowered into the pits and being withdrawn by these means. When the contents have been melted, the pots are removed from the pits and, immediately the pot is on the floor, a second man with a pair of tongs of different design picks up the pot and carries it to the cast iron ingot moulds. With the same tongs, the man tips up the crucible and pours out the steel into the ingot moulds. In each pot there is from sixty to eighty pounds of steel, and the smallest of the ingots requires about one hundred pounds of the metal. All the various sizes of the cast iron moulds are in the casting pits, which are part of the coke oven bay. The pouring of the steel is a very delicate operation indeed, great care being taken to prevent the molten metal from touching the sides of the cast iron moulds. The latter are always heated before the metal is poured, but even then the difference in the temperatures of the two metals is so great that the iron will chip and flake if the molten steel comes in contact with the mould sides when being poured. Extreme care is also taken to prevent the metal from piping upon cooling. After the removal of the ingot from the mould it is carefully examined for flaws such as chipped pieces of cast iron, blow holes, uneven surfaces, piping, etc. If any flaws are

MACHINE SHOP LOOKING FROM NORTH WEST CORNER.

discovered they are immediately ground out.

The Annealing Furnaces

The next bay is a narrow one being but twenty feet, and where the annealing furnaces are located. These are of a patented design, the chimneys having clear head room above. The furnaces open into the casting pit and coke oven bay. After the ingots of steel have been ground, they pass on and are placed in the annealing furnaces, and while there undergoing the heat treatment, not one bit of free oxygen comes in contact with the steel. If free oxygen were to come into direct contact under the high temperature of the furnace muffle, the oxygen would tend to combine chemically with the alloys which entered into the composition of the steel. After the steel emerges from this furnace the product is ready for use. Among the famous brands of Armstrong-Whitworth steel that are made by this process are the A. W. Premier, A. W. Ordinary, A. W. Special, and T Y R. Before these ingots progress through the plant, they have to undergo a final test by an expert and, when the steel has passed this, it is ready for working into the various shapes.

Converter Room—Main Bay III.

This, the third main bay, is 75 feet wide, and contains a 15-ton electric traveling crane. The base metal is received here, as in the mixing room, but in larger quantities. The ore and alloys which come in on the cars are here unloaded and mixed. Instead of crucibles, a steel converter capable of producing at least fifteen tons of steel per day, will be installed. The particular type has not as yet been decided upon, but it will be either a Stocks oil-fired of the latest type, or one of the improved type electrics. This bay is also equipped with modern casting pits and annealing furnaces. The steel produced in this department will be a high quality carbon steel similar to the Dura brand, with tempers from No. 5 to No. 8. Steel of this quality is used for punches, dies, cold chisels, mining drills an,d similar tools. In this department the same extreme care has to be exercised to produce ingots of the same perfect structure as those obtained in the High Speed Steel Department.

Rolling Mill Bay—Main Bay IV.

This bay is 60 feet wide and is equipped with a 5-ton electric traveling crane. There is also installed a 12-inch Lamberton mill, which is driven by a 300 h. p. Canadian Westinghouse direct current reversing motor of 500 volt type. The motor and switch board are entirely enclosed in a fire-proof room of galvanized metal, and all the starting resistances, and all the various wiring in connection with the starting and reversing apparatus, are placed below the level of the floor of the little motor enclosure. They are, of course, quite accessible in case of any derangement of same, and the switch board operator when attending to his duties at the board can have an uninterrupted view of the mill through a glass door. The motor is connected to the mill through the medium of a Lamberton slip clutch and, a 16-ton cast iron fly wheel is mounted on the mill shaft.

On the north side of the bay is a heating furnace for treating the ingots of steel before rolling them. The chimney of this furnace is placed so that it leads up through the minor bay between the third main bay and this the rolling mill bay. While the steel is being heated here, it is also away from the effects of free oxygen when in the muffle of the furnace. This precaution is found necessary in each case to preserve the structure of the material as free oxygen is very active chemically in the presence of great heat, and would tend to combine with the elements which give to the steel its physical properties for which it is so justly famed. It is thus imperative to preserve intact the composition of the steel. When billets are removed from the furnace, one would naturally think that air would enter the muffle, but experience has shown that the outward rush of the heated gases from the muffle keeps out all air tending to enter the muffle. On the other side of this bay is located a reheating furnace.

The billets are removed from the heating furnace and put through the rolls, and after the bars leave the rolls they are straightened, the large ones on a cast iron straightening plate 15 feet long by 5 feet wide, while the smaller bars are straightened in a reeling machine manufactured by Samuel Platt of Wednesbury, England. From the straightening operation, the bar goes to a shearing machine manufactured by Craig & Donald, of Paisley, Scotland. The bar is here trimmed of any shear ends or other defects. There is also located here a roll lathe for the machining of rolls for special sections and for the repair of standard section rolls. The standard sections rolled are rounds, squares, octagons, and flats, to four inches in diameter.

Hammering Bay—Main Bay V.

Passing on through the narrow chimney bay to the south, the hammering bay is entered. This is 50 feet wide and is, equipped with a 5-ton electric traveling crane. Here all billets that require hammering are brought. Among the varieties of steel that it is necessary to hammer is the high speed tool steel from which is made the various small tools such as milling cutters, drills, taps, etc., etc. A very complete range of hammers is found here, and all are of the latest design of steam type. They were manufactured by the John Bertram & Sons Co., of Dundas, Ont., and by the B. & S. Massey Co., Manchester, England. There are installed hammers of the following sizes:—3 ton, 1 ton, 12 cwt., 8 cwt. and 4 cwt., and each is fitted with all attachments to produce any size, type, or shape of bar. It is the intention of the company to manufacture all kinds of steel forgings when the factory is completed and the business fully established. There are seven furnaces of various sizes to accommodate the various hammers, situated so that they open on this bay, and the furnaces are so fixed that they chimneys are in the two narrow bays on either side of the hammering bay. After hammering, the billets go to the swing grinders

MACHINE SHOP SHOWING STORE ROOMS AND TOOL STORES IN BACKGROUND.

where all defects such as laps, seams, etc., are ground out.

Warehouse Bay—Main Bay VI.

Still traveling to the south, we pass on to the warehouse bay. The length of the shop is here increased to 175 ft. The width of this bay is 50 feet. There are here eight rows of racks made up of individual sections of special designs, each individual rack consisting of sixty compartments of varying sizes. There will be stored here a large stock of the finished bar steel when the factory is in operation. The racks are constructed of $1\frac{1}{4}$ inch wrought iron pipe and present a very attractive appearance. There is a 5-ton electric traveling crane which operates on a runway extending down the whole length of the bay, also several Reiner straightening machines for straightening and reducing bars to their exact standard size. There are also to be found here two power hack saws manufactured by E. C. Herbert, Manchester, England. Non-oxidising furnaces are also installed in this bay, where bars that require this treatment are annealed. The annealing causes all internal strains to be removed from the steel and makes a homogeneous structure of a very fine grain.

As has been stated, this bay is the first one whose length exceeds 100 feet. The extra 75 feet extension is toward the east where is located the hardening department.

Hardening Department.

This shop consisting of the eastern end of the warehouse bay, extends over the whole width of the latter namely 50 feet, and is 75 feet long. Perhaps in no other department of the whole plant does there rest so much responsibility with the workman as in the hardening department. Its importance cannot be too strongly emphasized, for here the very finest steel can be ruined by an unskilled man. The whole of the operations here executed are of a highly scientific character. On entering from the warehouse room there is located to the left a large patent tempering and hardening furnace, which is also of the non-oxidizing type. This furnace is capable of heating steel bars or shear blades up to 96 inches in length.

Situated in front of this hardening furnace is a round wooden stave brine tank 6 feet in diameter and 16 feet deep. This is used for treating the water hardening type of steel. The capacity of the tank is 2,800 Imperial gallons. Various types of tempering and hardening furnaces are arranged around the three walls of this room, several of which are of Armstrong-Whitworth design and have been built entirely by the engineers and employees of the firm. Four of the furnaces are, however, of the Stewart type, manufactured by the Chicago Flexible Shaft Co. There is also one electrical furnace installed, to a large extent for experimental purposes. This was manufactured by the Canadian Hoskins Mfg. Co., Walkerville, Ont. Between the furnaces along the walls are cooling benches, each equipped with air blasts and water pots. On one side of the department are situated the furnaces for the tempering of high speed steel, while on the other side are to be found the furnaces for tempering carbon steel. These furnaces are all of the oil blast type, receiving oil from an auxiliary tank located on a roof truss. This tank receives its oil from the main storage tank which has a capacity of 15,000 Imperial gallons. The oil which is light fuel oil is pumped from the main storage tank to the auxiliary tank in the roof truss. Situated in the centre of the hardening department is a steel oil hardening tank. This tank is let into the floor and has a capacity of 860 Imperial gallons. On account of its central location it is easy of access for all of the furnaces.

VIEW IN HAMMER BAY.

The welfare of those employed in this department is well looked after. Over each furnace is located a steel hood which collects all the fumes and gases and conveys them through pipes to the atmosphere. For this reason the air is practically free from all objectionable features. Both high pressure and low pressure air blasts are available in this department. The high pressure is furnished by a Keith fan, while the low pressure air is supplied by No. 5 American blower manufactured by the American Gas Furnace Co., of Elizabeth, N.J.

Machine Shop Bay

This bay is the largest one of the plant, the width being 100 feet and its length 175 feet. The floor is of hardwood throughout. In the western end is situated the superintendent's office and those of his assistants. On the top of these offices, the drawing department is located. In the eastern end of the bay are to be found the tool store rooms. Lavatories for the men are situated on a mezzanine floor off the wall at the northern side of the bay. This wall separates the machine shop from the warehouse bay and the hardening room. The lavatories are furnished with the most modern equipment, and it shows how, even in the smallest details, the welfare of the men has not been overlooked. Situated as it is in the gallery, no floor space in the body of the shop is utilized. The light in this department through the spacious windows in the walls and the generous area of the skylights is unexcelled anywhere.

On the hardwood floor of the bay is located the large number of machines used in manufacturing the various high speed tools. As will be noted later, a number of these machines have been specially designed for the work which they will be called upon to execute, this having been found an absolute necessity because the rapid, economic, and accurate production of small, high speed steel steel tools cannot be accomplished through the medium of machines of standard design. The equipment is all so arranged that machines executing similar operations are in a group, and the groups again are so arranged that the progressive operations are facilitated

as much as possible. Thus, as a particular piece travels through the shop, the successive operations are performed on the adjacent machines, and the journey through the shop is continued in the same general direction all through. Further, the present complement of cutters, reamers, drills, etc. This group of machines is driven from a line shaft, which is in turn driven by an electric motor. The whole shop is laid out so that each group of machines doing similar work is driven by a line shaft, which is driven by its own individual motor.

MACHINE SHOP LOOKING NORTH EAST.

tools, although complete in itself and arranged to excellent advantage for rapid, accurate, and economic production, forms only a portion of the equipment which the shop has been designed to accommodate. When the increase in business causes the present equipment to become inadequate, it will be in no way necessary to remove any of the present tools from their positions, nor will the line shafts have in any way to be altered for the accommodation of additional machines.

The steel enters the shop and is immediately placed in the hack saws, the round bars most commonly used in the manufacture of high-speed steel machine tools having all been hammered and annealed before they pass into the machine shop bay. The power hack-saws cut these round bars to the various lengths required. Among the various hack-saws there is one automatic power saw. This machine can be adjusted so it will cut automatically a whole bar into long or short lengths as desired, and have each length similar without attention or adjustment after the first setting. These machines are all of British manufacture being from the shops of the E. C. Herbert Co. From the hack-saws, the steel goes to the centering machine where centers are placed on both ends of the pieces of steel. This centering machine was manufactured by the Hendey Machine Co., of Torrington, Conn. Next in order come the Reed-Prentice, and the Lodge & Shipley lathes. On these lathes the pieces of steel are turned down to size, in the process of being made into milling

The motors used are of various types, some are Canadian Westinghouse, some Canadian General Electric, and others are of British manufacture.

Nearby is a group which comprises several machine tools especially designed and constructed for the Armstrong-Whitworth of Canada. These machines perform certain operations in the manufacture of twist drills, and they as well as certain others of the automatics are set at a slight angle so that when long bars are placed in them they will not interfere with neighboring machines. The angle is only a slight one, simply allowing the bars to miss the other machines but, to prevent the belts from running off the pulleys small iron guides are placed so as to guide the belt. Another group of machines nearby consist of Landis grinders, upon which is executed the rough grinding of small tools before these are fluted.

Milling cutters are gashed on Browne & Sharpe and Cincinnati Universal milling machines specially designed for this work. Each machine is driven by its own 10 h.p. motor. Nearby is another specially designed machine used for machining tangs on the end of drills and squares on the end of taps. A group of specially designed machines take care of tap threading. Another Cincinnati milling machine is also equipped for the express purpose of fluting taps. Several drill presses are located throughout the shop, these including both single and twin spindle types.

The finishing grinders were manufactured by the Norton Grinding Co., of Worcester, Mass., after Brown & Sharpe designs. On these machines are executed all the operations in connection with the finishing to size of all tools, such as drills, cutters, taps, reamers, etc. A little further along is a group of machines upon which the points of drills are ground at the proper angles.

All drills are tested to double working capacity on a powerful Bertram single spindle drill press before being put into stock for shipment. This machine is driven by a 20 h.p. Canadian Westinghouse direct current variable speed motor.

Another special machine is one designed by the Armstrong-Whitworth Co., on which hobs for worm gears and gear cutters are machined. There is also a John Bertram & Sons shaper located in this bay, which is driven by an independent 10 h.p. motor. Meantime, there is abundance of floor space in this bay for the further addition to the machine tool

PART OF HAMMER SHOP, SHOWING ONE OF THE FURNACES AND TWO HAMMERS.

equipment. The shafting and hangers were all supplied by the Canadian Fairbanks-Morse Co., the hangers being all of the ring oiling type. The pulleys were supplied by the Dodge Mfg. Co., Toronto, and the belting by the J. C. MacLaren & Co., Montreal.

The Boiler Room.

Adjoining the main building, but on its west side, are located the boiler room and the power house. These are under one roof and separate from the main structure. A battery of two Babcock & Wilcox boilers is installed. each unit being of 500 h.p. These boilers are fired by hand and operate under natural draft. The stack is 150 feet high and has been designed to take care of 2,000 h.p. with the ordinary provision for overload. The stack is nine feet inside diameter at the top and was built by the Alphonse Custodis Chimney & Construction Co., of New York City.

There are two principal uses to which steam is put. One is for the steam hammers which require about 400 horsepower, out of the total capacity of 1,000 horse power generated. The second use of steam is for the purpose of heating. The exhaust steam from the hammers is piped into the heating system, a back pressure of three pounds being maintained in the exhaust line by Cochrane multiport back pressure valves. Before reaching these valves, the steam passes through Bundy oil separators. Should the exhaust steam at any time not be sufficient to maintain the required back pressure, live steam is introduced into the heating system through Mason reducing valves. The steam pipes are led through conduits in the concrete floors and, to present an uninterrupted floor space, these conduits are covered with steel plates. Thus the pipe lines are accessible at all points at a moment's notice.

The radiators are placed along the walls extending from the floors to the bottom sills of the windows, and an extremely generous radiating surface is provided so that, in the most severe weather, no difficulty will be experienced in maintaining the desired temperature. Traps are fitted to each radiator thus all returns are condensed. Two simple Bawden vacuum pumps, in conjunction with Webster vacuum valves, return all condensation to a low pressure Cochrane feed water heater. The boiler feed pumps are of Smart-Turner manufacture, and are of the Duplex, outside-packed, double acting pattern.

Water Supply.

A very unique system of water supply has been designed to meet the requirements of the plant. The water is obtained from the St. Lawrence River some 1,800 feet distant from the main supply tank. The main tank was furnished by the Chicago Bridge Co., and is built on a steel tower on the west side of the plant. The height of the tank top above the ground is 106 feet. The tank embodies some very interesting features in design. The total capacity is 70,000 Imperial gallons, but is so designed that only 30,000 gallons are available for general purposes, the other 40,000 gallons being reserved for special fire protection. This is accomplished by special arrangements of piping in the tank interior. In the power house there is a mercury manometer for registering the height of the water in the tank, and this provides an easy method of keeping track of the quantity of water. The device really consists of balancing a column of mercury against a column of water.

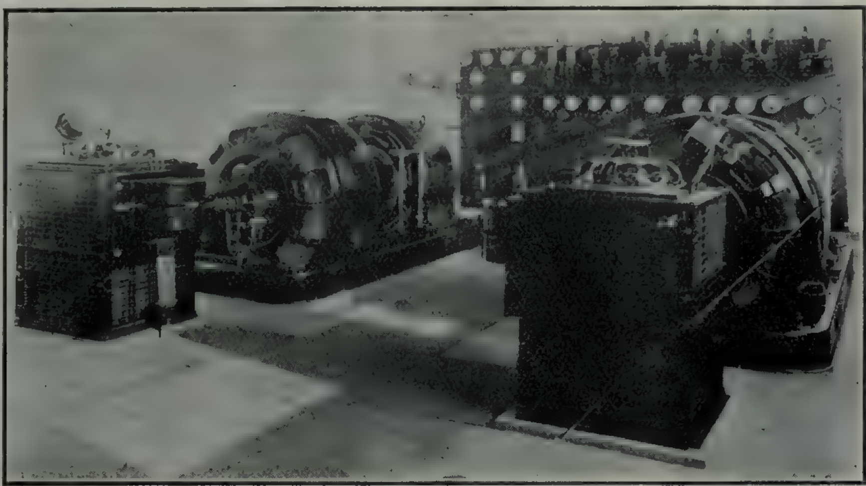
There are two centrifugal, direct connected, motor driven, Canadian Allis-Chalmers pumps located in the pump house on the river bank, the motors connected to the pumps being Canadian General Electric, alternating current, and of 50 h.p. each. The intake consists of a sluice way or tunnel from the river to underneath the pump house, the smallest cross section of this tunnel being three feet by two feet. There is an 18 foot suction lift and each pump is capable of supplying 770 Imperial gallons per minute against a pressure of 75 pounds per square inch, which pressure is equivalent to discharging against a head of slightly over 170 feet. The discharge pipe is 8 inches in diameter. In the pump house is a special arrangement of piping which allows either pump to be operated independently of the other, delivering its full capacity.

These pumps can also be operated together in two different ways, namely, in series, or in multiple. When in series, the one pump receives water from the river and discharges into the second pump; then the combined output of the two pumps is the same as for one pump but the water is discharged against twice the pressure, or to express the same in figures the two pumps will discharge 770 Imperial gallons per minute against a pressure of 150 pounds per square inch, or against ~ head of 345 feet. When operated in multiple, the pumps discharge at the normal pressure of 75 pounds per square inch but twice the quantity is discharged, namely, 1,540 gallons per minute. This pumping unit thus provides the plant with a very efficient water supply, not only for ordin-

VIEW IN HAMMER BAY LOOKING EAST AND SHOWING ALL FIVE HAMMERS.

ary use, but it is particularly efficient in case of fire, providing a pressure which is far in excess of that usually obtained in the mains of most cities under the most favorable conditions. The reserve of 40,000 gallons in the tank always insures a supply with which to fight a fire until the pumps can be put into action.

A further very interesting feature in connection with the water tank is the fact that a water heater is situated at the bottom of the tank trestle. Live steam is supplied to this heater and circulation is obtained through the thermo-syphon system principle, making use thereby of the fact that warm water will rise above cold water. This heater is part of the equipment supplied by the Chicago Bridge Co. The water being always kept in circulation is prevented from freezing and causing a tie-up in the supply.



MOTOR GENERATOR SETS IN THE POWER ROOM SHOWING STARTING APPARATUS AND SWITCHBOARD.

The Transformer House

Some two or three hundred feet to the south of the main building is located the concrete transformer house. Current is received from the Montreal Light, Heat & Power Co. at 22,500 volts. Installed in the transformer house are six of the latest type of North British transformers which step the current down from 22,500 volts to 2,250 volts. In addition to the six transformers, there is a duplicate set of lightning arresters and high tension oil switches furnished with remote control and interlocking devices. Further, these high tension oil switches are equipped with overload release relays, operated by means of current transformers. The current is carried to the power house through underground conduits.

The Power House.

In the power house are two Bruce-Peebles motor generator sets, through the medium of which the direct current electricity at 500 volts in use throughout the plant, is obtained. The d.c. generator ends of these sets are each of 350 kilo-watt capacity, while the guaranteed power factor of the motor ends is unity or 100 per cent. The units are very compactly designed, while the switch boards which are extremely well equipped and present an extremely neat appearance, were built by the electricians of the company. The motors of the motor-generator set are synchronous machines and the method of synchronizing them is unique. Direct current electricity is used on all the variable speed motors throughout the shop, and these include all the crane motors as well as the motors in the machine shop.

In the boiler room is located a simple Armington & Sims 50 horse power steam engine fitted with a flywheel governor. This engine is of horizontal design, runs at 250 r.p.m., and is belt connected to a 50 kilo-watt, 500 volt, direct current, Westinghouse generator. This unit is held in reserve in case a breakdown should occur in the transmission lines of the power company.

General.

Both the natural and electric lighting systems are exceptionally good and all the conditions under which the workmen labor closely approach the ideal. The equipments and the appointments of the plant in general have been carefully studied and in no department have any details been overlooked.

Foremen of the various departments have been brought over from the parent plants to educate the local men along the different lines of the industry. The policy of the company has been to employ as far as possible Canadian labor. It has also been the policy of the company to purchase as far as was possible, tools, machines, supplies, and equipment from local firms.

The advent of this plant into the circle of Canadian industries marks a new era. It is the only crucible steel plant in Canada, and the quality of the steel to be produced, it is claimed, will not be surpassed by any other high speed tool steel in the world. Such an institution is one of which all those identified with the engineering pursuits of this Canada of ours should be justly proud. The general offices of the company are at 22 Victoria Square, Montreal, and the officials of the company are as follows:—

President—Sir Percy Girouard, K. C. M. G.

Vice-President — George G. Foster, K.C.

Director—John D. Noble.

Managing Director—M. J. Butler, C. M. G.

General Superintendent—W. Furniss Clarke.

Sales Manager—Lawrence Russell.

SHELL ORDERS.

IT is expected that more than a hundred Canadian firms will eventually be working on an order from the Imperial Government calling for 250,000 shrapnel shells per month until the total number of 1,800,000 called for has been filled. Already, it is stated, fifty different manufacturers in Canada are employed in this new business, each taking some portion of the work to be done. Nearly all of the Canadian steel companies have put in the plant necessary for the business of shell-making, but the order embraces many concerns other than the steel companies. All the materials used are products of Canadian firms. How much material this order will take can be judged from the fact that four thousand tons of lead bullets will be used to complete it. British Columbia lead will be used for a portion of it.

Representatives of manufacturing firms from various parts of the Dominion have been at the Capital seeking information concerning the new industry, and expressing their willingness to place the facilities in their plants necessary for the work. By so doing very considerable employment can be given. It is stated that there is work enough for every firm in Canada which is in a position to manufacture one or more of the parts required. Some of the orders are for steel for French manufacturers. There is an indication that Russian orders also will be placed in the Dominion for this sort of war material, and if so an important new industry will be established in Canada to tide manufacturers over the war.

A. K. Grimner, city engineer of Medicine Hat, Alta., has handed in his resignation.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

FLAT SPRING FORMING DIE AND INDICATOR.

By A. L. Monrad.

AN order came in for several thousand flat-formed springs, and was backed by a duplicate order if they were up to the standard of the sample furnished. As we already had some experience in this line, we concluded that accurate bending was the most essential point, and if anyone is looking for a cheap product of this kind, I think the method of manufacture here explained will be highly satisfactory.

Forming Device.

The die we employed is sometimes known as a twin die. It will punch on either side as well as on top, as the case may be. On such a job it has been found to save three handlings of the work. The punch plate A, Fig. 1, is made of cast iron planed and finished to dimensions all over. On each side of the plate are milled out two slots to a driving fit to receive the four sub-press pins C, which operate the side T-slides D. These pins, C, are made of machinery steel, casehardened, and each is secured to the plate A with a fillister head screw and two dowel pins. The sub-press pins are 1 inch square all the way except at the bottom where the ends are ground cylindrical to a plug fit in the bushing J. About the middle of the squares in the two end pins is milled a traversable

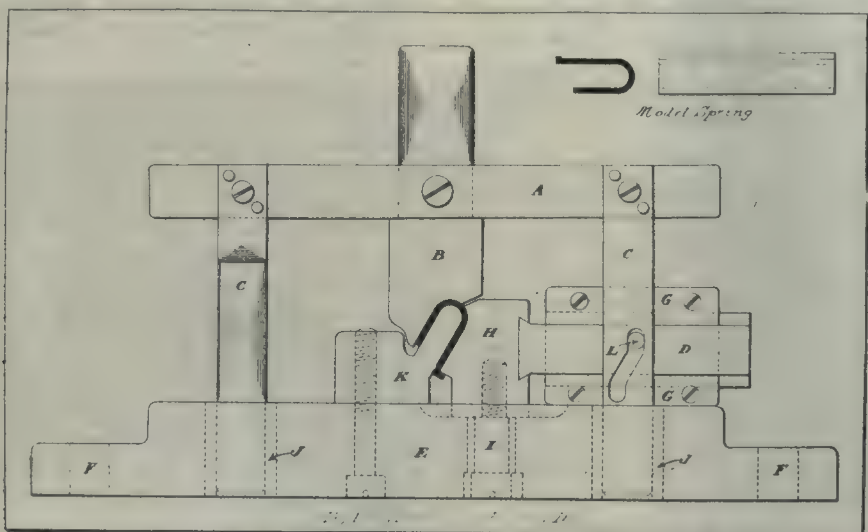


FIG 1.—SUB-PRESS SPRING FORMING FIXTURE.

$\frac{3}{8}$-inch slot to a true fit for a roller bushing connected with the T-slide D.

Forming punch B is made of low-grade tool steel, hardened and tempered to a straw color. It is held rigid by a driving fit through the cast iron plate A and a centre screw from each side. The exact shape of form is obtained by trying a few blanks before hardening. The bolster E is made of close-grained

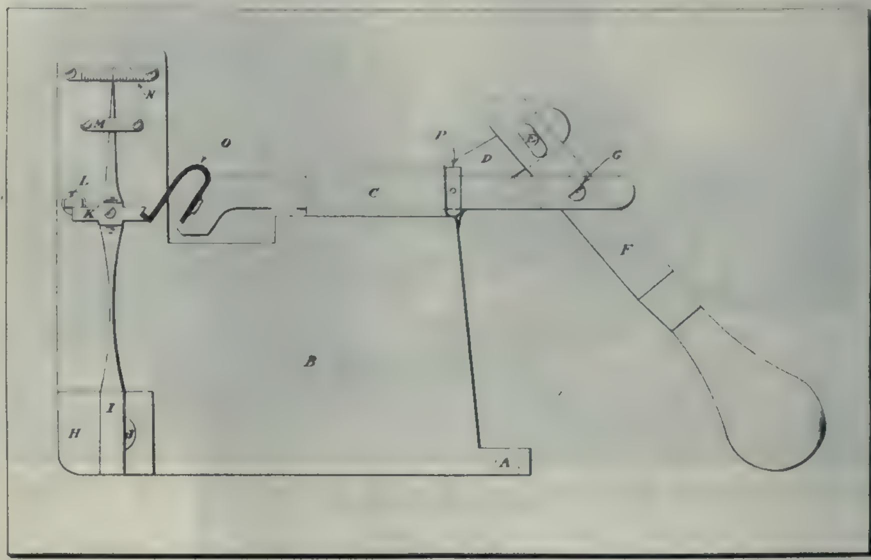


FIG 2.—SPRING TESTING DEVICE.

cast iron, planed on both sides and, when located in the press, is secured with two hexagon-head press bolts through the holes F on both ends. The T-slide block G which holds the T-slides D is made of cast iron, with a milled groove on each end to fit the T of the slides. These are secured with a sliding fit by two plates held with four machinery screws. The block G is fastened to the bolster E by means of two fillister screws and two dowel pins from underneath which are not shown.

The forming block H is made of low-grade tool steel and conforms to the shape of the spring required. This can only be determined by trying a few blanks in the press before hardening. The sliding block is held to a sliding fit on the ends of the block H in the die bolster E, which has a rib on each side, and is retained in a movable position on each end of the block by a shoulder screw, I, with a large head to keep it firmly in position. On each end a dovetailed cut is taken to fit the T-slides D and, in this position, the block is secured to the T-slides, with no possible chance of getting out of place after once being located.

The stationary forming block K is made of tool steel and conforms to the shape of the spring required. This also can only be determined exactly, after trying a few blanks in the press before hardening. This block is held in position in the same manner as block H, with dowel pins to make it more rigid. The former is hardened in fish oil and drawn to a dark straw color. The T-slides, D, are made of machinery steel and casehardened, being a nice sliding fit in the block G. The slides are held in position with a plate on each side and three fillister screws.

In the middle of the T-slides is driven in a head pin with a hardened steel bushing L on the end; this acts as a roller when traversing in the sub-press pin slot with a true fit on the sides. The die plate E is drilled and reamed to a driving fit for receiving the hardened steel bushings, J, which are ground and

lapped to a plug fit in order to guide and support the four sub-press pins C. When they are up to the highest point they remain in the bushing holes about ½-inch. In so doing they are well supported when taking the thrust on one side during the downward motion when forming the spring. This die was made for a press having a two-inch throw, and the T-slides had to have a lateral travel of about ⅜ inch. While the ram of the press is traveling, the slides D move the required distance by traversing in the slots of the two sub-press pins C.

The blanking was done in a press of the inclined type. With the end cut square, it forms the right angle and cuts off with one stroke of the press. The second operation is performed in a roller forming fixture, which is a very quick operation, but which could never be depended upon for accuracy, as they would vary from five to twenty-five thousandths from the proper shape. By sliding this formed blank in the die to the stop pin on the other side, it forms the shape from two sides at once with one stroke of the press, thereby giving it a uniform bend with a variation of only three thousandths.

Gauging Fixture.

After being spring tempered to proper torsional elasticity, they are tested in the testing fixture, Fig. 2. This spring indicator is made so it can lay down flat on a bench or can stand upright and be bolted securely by the hole A. The plate B is made of cast iron, is hollow inside, with walls about ⅜ inch thick, and is planed on the bottom. The spindle hole C extends above, so that when the spring is in position it will clear the plate. An arm D extends out 45 degrees, and is about 1 inch thick. The top is planed and a pin E is driven in.

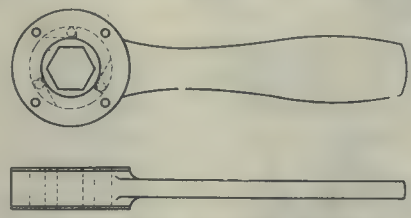
The lever F is fastened to the sliding spindle C by means of the shoulder screw G, and pivots about the pin E in the slotted hole, as shown. A wooden handle is driven on the other end of the lever. The corner block H is cast on the plate, and extends up about one inch. A ⅝-inch hole is drilled through this block and a slot milled through on top, leaving a part of the hole, as shown.

Different indicator points I are used for different widths of springs, and are held firmly in position by driving up the segment key J. In about the middle of the indicator is located an extension plate, K, held in a swinging position by a shoulder screw so as to give the spring a perfect seating, as it is indicated forward. A flat stop pin L is driven into the cast iron plate B at the end of the extension plate for the plate K to rest against. A cross plate M fastened with two screws holds the indicator down, and a graduated piece N serves to indicate the amount of the variation. Placing the flat spring O in the seat of the spindle C and moving the lever F forward to the ring stop P will register the spring to the proper tension.

REVERSIBLE RATCHET WRENCH

By A. S. Loy.

THE drawing of the ratchet wrench is practically self-explanatory. The body is of mild steel and case-hardened, be-



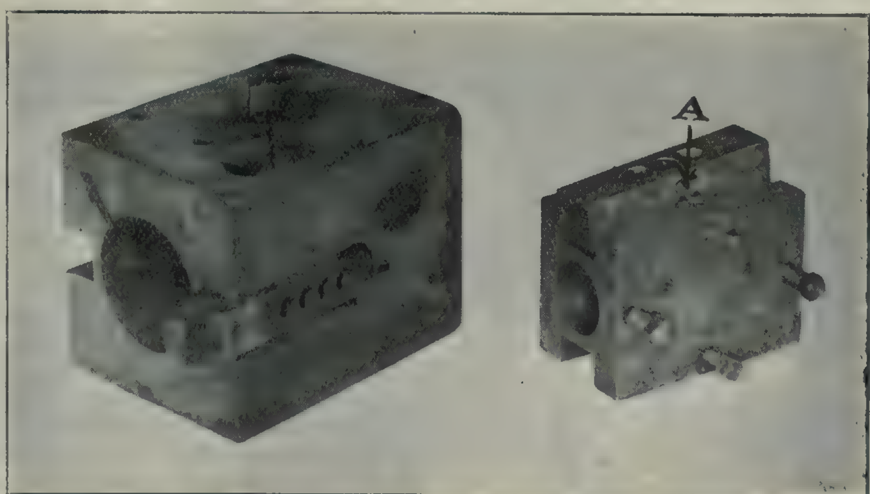
REVERSIBLE RATCHET WRENCH.

ing bored to receive the tool steel centre piece which is broached out for the proper shape on which it is to be used. This center piece is cut away at the three points to receive the rollers which are of drill rod and are backed up or rather pushed into the narrow portion of the openings by small springs which are not shown. The centre piece is held in position by means of the thin steel disks riveted on either side. The centre projects up through these centre pieces so as to be flush at the sides. To reverse the direction of rotation, it is only necessary to turn the wrench over. The rollers have a good "bite" and take hold immediately, so that there is practically no lost motion, and it is possible to use this wrench in crowded places where the movement would not be sufficient for the ordinary type of wrench.

KEYWAY DRILLING-OUT JIG.

By A. E. Granville.

THE type of drilling jig shown is very convenient for drilling out keyways in shafts, either single or with two opposite each other. The body of the jig consists of a block of cast-iron, while the drill guiding strips are of tool steel hardened and drawn. The block is held on the shaft to be drilled by ordinary set-screws, but the bushings are held in place by a pointed set-screw. There are two locating spots on the side of the steel strip for each set of holes to be drilled. When one lot is drilled, the strip is moved forward till the pointed set-screw will enter the other spot, then the webs left between the previously drilled holes are drilled out, leaving very little to chisel out. The piece A shows two sets of locating holes on the side. These are used for opposite sides of the shaft.

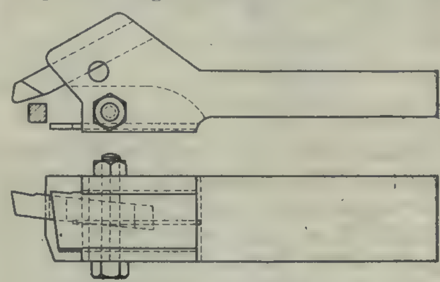


KEYWAY DRILLING-OUT JIG.

A PISTON RING LATHE TOOL.

By D. S. Mann.

THE accompanying drawing shows a tool used in the turret lathe for facing and cutting off piston rings. The rings were both bored and turned with a regular piston ring attachment from the tur-



PISTON RING LATHE TOOL.

ret leaving the cross-slide free for parting the rings. In this case a multiple tool for cutting off the rings would be of no advantage as it was possible to cut them off singly and keep up with the boring and turning so that all the operations were completed simultaneously. Not

The facing tool was of ⅜ in. square being equipped with a piston ring grinder, it was also necessary to face one side of the rings.

steel held in place by a 5/16 in. pin, milled off and driven in at a taper, this tool being set far enough ahead, of course, to clear, by the time the parting tool has entered. The slot holding the parting tool was bevelled both top and bottom, and the tool holder body split with a slitting saw. A bolt through the body served to clamp the parting tool. Various widths of rings, if necessary, could be accommodated by moving the facing tool in its slot, it being but a moment's work to set for any particular size.

Layout of a Four Piece Ship's Ventilator Cowl

By J. W. Ross

The very practical piece of development and layout work herein described, although the direct answer to a query from a subscriber to Canadian Machinery, if well studied and understood, will be found to cover a wide field of sheet metal problems. The practice as set forth is applicable to many forms of irregular pipe bends and junctions and illustrates some distinct advantages of longitudinal over girth seams under certain circumstances.

FIG. 1 shows a ventilator cowl built up of four pieces with vertical seams. This type of cowl is much preferable from its visual effect to that made up with girth seams. Fig. 2 illustrates the construction of the cowl, the layout of which may be drawn to any desired scale.

Measure off A B equal to 20 inches, bisect at P and raise the vertical line V P equal to 40 inches. Draw the overhang V C at right angles to P V and equal to 18½ inches. With E as centre and radius (equal to 25 inches) draw in the arc C K F J so as to be tangent to the perpendicular A J raised from A B. Raise the perpendicular B L M.

Locate the point G, which is 4 inches above the line A B and 2 inches from B L M. With G as centre and 2 inches radius, strike the quadrant M N D tangent to B L M. Directly above the point G locate D, which is on the quadrant M N D. Connect by a straight line the points D and C, thus completing the outline of the cowl. Now divide the back into four equal parts as shown by A J F K C. Similarly divide the throat sheet line into the same number of equal parts as shown by the points B L M N, and D. Connect these points by straight lines to their relative points on the back sheet line, as J L, F M, K N. These lines will be used as sectional planes and on them will be constructed the half sectional views.

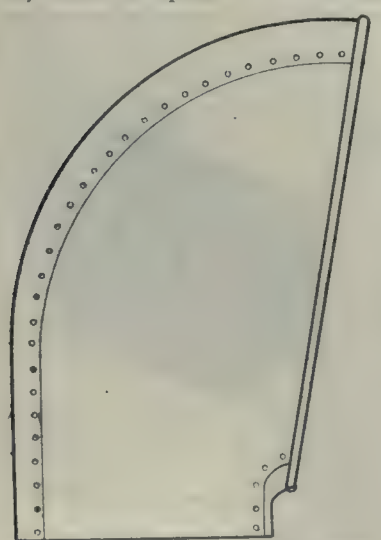


FIG. 1. VENTILATOR COWL WITH VERTICAL SEAMING.

With P as centre and radius P A, strike the semicircle A P° B, thus defining the half-sectional view through the plane A B. Bisect J L at Q, then with Q as centre and radius Q J strike the semicircle J Q° L. Again, with R as centre, describe the semi-circle F R° M. Similarly with S K and T C as radii, strike the half section views K S° N and C T° D, respectively.

It is the usual practice in this type of cowl to make the back and throat sheets each equal to one-sixth of the circumference and the side sheets each equal to two-sixths. On this principle, our patterns and templets will be developed. Divide the semi-circle A P° B into exactly six equal parts and locate the end points 1° and 2°. At right angles to A B project the lines 1° 1 and 2° 2, thus locating the points for the rivet lines. Divide the arc J Q° L into six equal parts, the extreme points 3° and 4° being projected at right angles to the plane J Q L, thus locating the rivet line points 3 and 4. Similarly, the arcs F R° M, K S° N and C T° D are each divided into six equal parts, their extreme division points being projected at right angles to their respective planes, thus locating the rivet points 5 6 7 8 9 and 10.

Erect the perpendicular 1 3 to the line A B, and with a suitable centre as at U, and radius U 9, describe an arc through the located points 9 7 5, and tangent to the perpendicular 1 3. The line 1 3 5 7 and 9 defines the rivet line for the back and side sheets. The rivet line for the throat and side sheets is drawn in a similar manner. Erect the perpendicular 2 6, and with a suitable centre draw the arc cutting through the points 6 8 4 and 10, and tangent 2 6.

For the development of the back sheet, take the distances A J, J F, F K and K C, transfer over to Fig. 3 and locate the points A J F K C on the straight line A C. Draw lines at right angles to A C through all these points. Measure off carefully along the curve the distance A 1°, Fig. 2, and transfer this over to Fig. 3 by measuring at each side of 1, locating the points 1° 1°, which will be equal to one-sixth of the circumference, through the plane having A B as diameter. Similarly measure J 3°, Fig. 2, and transfer to J 3°, Fig. 3. Again, transferring all the distances as F 5°, K 7° and C 9°, measured along the curve

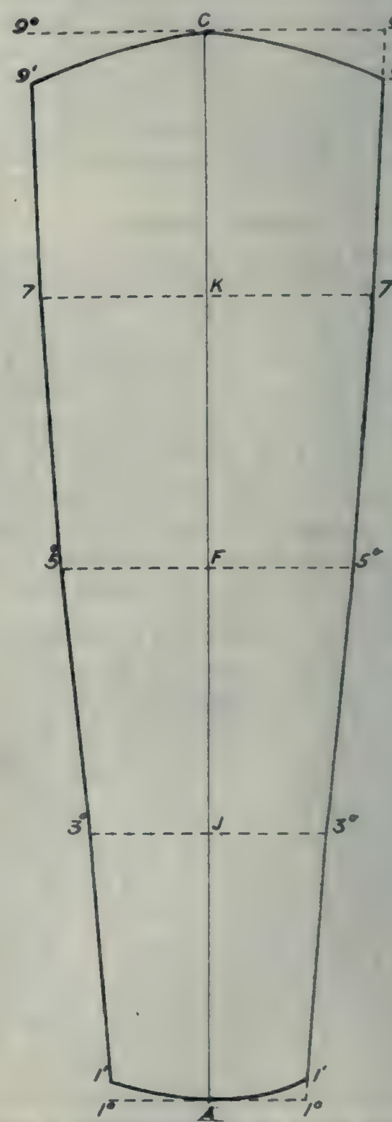


FIG. 3. DEVELOPMENT OF BACK SHEET.

(or calculated), Fig. 2, to their respective locations in Fig. 3, an even curve is drawn in through these points by the aid of a flexible batten.

It will be observed that in Fig. 2 the line 1 3 5 7 9 is shorter than the line A J F K C; this, then, will have to be shown in Fig. 3. From the located point E, draw a straight line to F, locating the point F^2 where this line intersects the rivet line, Fig. 3. Measure carefully along the curve from this point F^2 to the point 9. This distance is then measured from 5° to 9^1 in Fig. 3. The distance F^2 to 1, Fig. 2, is next transferred to Fig. 3 as from 5° to 1^1. Suitable curves are drawn through the points 9^1 C 9^1 and 1^1 A 1^1 respectively. This completes the templet for the back sheet; laps, of course, to be added as required. If the reader is in doubt about the curves 9^1 C 9^1 and 1^1 A 1^1, perhaps it would be just as well to prolong the rivet line from 9^1 to 9° and from 1^1 to 1°, thus leaving the ends square. It will require in any case to be "dressed" after being "blocked" or hollowed out.

The throat sheet is developed in a manner similar to the back sheet. The distances in Fig. 2, B L and L M, M N and N D measured along the curve, are transferred over to Fig. 4 and located on the straight line by the points B L M N D. Parallel lines at right angles to B D are drawn through these points. In Fig. 4, B 2° is made equal to B 2°, Fig. 2, which is also equal to A 1°, Figs. 2 and 3. Again, L 4°, Fig. 4, is made equal to L 4°, Fig. 2. Similarly the distance M 6°, N 8°, D 10°, Fig. 2, are transferred over to their respective positions in Fig. 4. It will be observed that the distances B 2°, L 4°, M 6°, etc., Fig. 4, are equal to the distances respectively A 1°, J 3°, F 5°, etc., in Fig. 3. Through these located points draw an even curve with the flexible wooden batten, as was done in Fig. 3.

It will be noticed that the rivet line 2 4 6 8 10, Fig. 2, is longer than the outline B L M N D. This extra length must be added on to the rivet line in Fig. 4. From the point G, through the centre of the quadrant M N D, draw the line G H. Measure from D to this intersection point on the quadrant, and transfer this distance over to Fig. 4, thus locating the line G H. From G^1, measured along the curve to 10, Fig. 2, transfer this distance to Fig. 4 by measuring from the line G H to 10^1. Similarly, transfer the distance G^1 to 2, Fig. 2, over to Fig. 4 as from the line G H to 2^1. Connect the points 2^1 B 1^1 and 10^1 D 10^1 each by suitable curves.

Fig. 4 shows the templet for the throat sheet, suitable laps to be added. The side sheets are developed in a slightly different manner. Transfer the outline of the side sheet as shown by 1 3 5 7 9 10 8 6 4 2, Fig. 2, to the similarly numbered outline in Fig. 5. Connect the points 1 P 2, 2 Q 4, 5 R 6, etc., Fig. 5, similar to Fig. 2. Measure off P 1″ and P 2″, Fig. 5, each equal to 1/6 of the circumference of which 2 B^1, Fig. 2, is the diameter, or measure along the semicircle the distance 1° 2°, Fig. 2, and place half of this at each side of point P, Fig. 5, to locate the points 1″ and 2″.

Calculate or measure off half the dis-

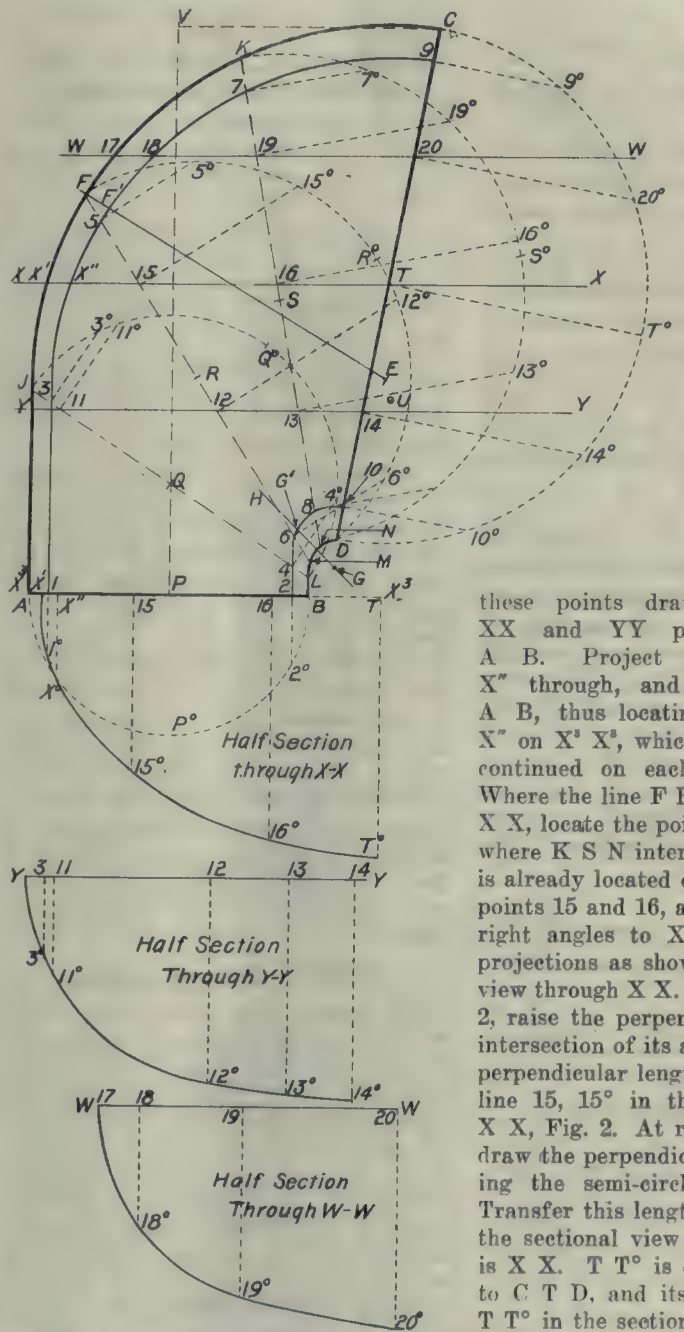


FIG. 2. GENERAL ANALYSIS OF VENTILATOR COWL CONSTRUCTION.

tance along the arc of 3° to 4°, Fig. 2, and place this distance at each side of the centre Q on line 3 Q 4, thus locating 3^2 and 4^2 in Fig. 5. Again, take the length of the arc 5° 6°, Fig. 2, and place half of this on each side of R on the extended line 5^2 R 6^2 to locate the points 5^2 and 6^2, Fig. 5. Similarly transfer the distances 7° 8° and 9° 8°, Fig. 2, to their relative positions to locate the points 7^2 9^1, and 8^2 10″. Connect the points 1″ 3^2 5^2 7^2 9^1 and 2″ 4^2 6^2 8^2 10″, as shown in Fig. 5. Measure the length of the line 1 3 5 7 and 9 and also the line 1″ 3^2 5^2 7^2 and 9^1. Take half the distance between these two lengths and locate the points 9^2 and 1^2 by measuring from 9^1 and 1″ respectively. Similarly measure to find out how much longer the line 2 4 6 8 10 is than the line 2″ 4^2 6^2 8^2″. Take this difference and add half from 10″ to 10^2 and half from 2″ to 2^2. Connect 1^2 to 2^2 to locate the outline for the bottom of the side sheet.

To obtain the curved line 9^2 to 10^2, it is necessary to find out the points W″ T^1 and Y″. This is done in the following manner: Divide C D, Fig. 2, into four equal parts, and through these points draw the planes W W XX and YY parallel to the line A B. Project the points X^1 and X″ through, and at right angles to A B, thus locating the points X^1 and X″ on X^3 X^3, which is shown on, and is continued on each side of A and B. Where the line F R M intersects the line X X, locate the point 15. Also locate 16 where K S N intersects the line X X. T is already located on X X. Project these points 15 and 16, and T, down to, and at right angles to X^3 X^3. Continue these projections as shown in the half section view through X X. On the elevation, Fig. 2, raise the perpendicular 15, 15° to its intersection of its arc F R° M. Take this perpendicular length and transfer to the line 15, 15° in the half-sectional view X X, Fig. 2. At right angles to K S N draw the perpendicular 16, 16° intersecting the semi-circle K S° N at 16°. Transfer this length 16, 16° to 16 16° in the sectional view for this plane, which is X X. T T° is drawn at right angles to C T D, and its length transfered to T T° in the sectional view.

The distance X″ X° in the sectional view is equal to the distance through X″ on the line X X in the elevation. This distance is not shown in the elevation view, but it is obtained by using a little judgment. The distance through the point 5 is equal to 5 5° and through the point 3 is equal to 3 3°, so if X″ was midway between the points 3 and 5, it would be equal to the mean of the two distances 3 3° and 5 5°. But X″ is nearer to 5 than 3, so it will be seen that it is not difficult to get the distance X″ X° for the cross-section. An even curve drawn

through the points T° 16° 15° 5° and X[1], in the section view, will define the half section for the plane X X.

The sections for Y Y and W W are constructed in a similar manner.

The plane lines W W, X X and Y Y in Fig. 2 are transferred over to their

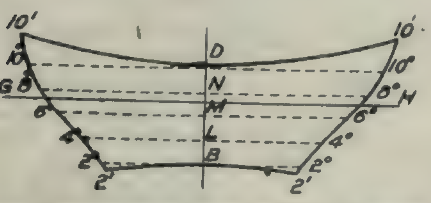


FIG. 4. TEMPLET FOR THROAT SHEET.

proper positions in Fig. 5. The distance X° 15° 16° and T° in the sectional view, Fig. 2, is equal to the curve of the side sheet; it is therefore transferred over to Fig. 5, measuring from the point X[4] along the line X X to the point T[1]. With the three points 9[2], T[1] and 10[2] located, the curve may be drawn in by a flexible batten. The points W″ and Y″ on this curve are located by taking the length of the curve 3° 11° 12° 13° and 14°, Fig. 2, and measuring this along the line Y Y, Fig. 5, from the point Y[1] to locate Y″. To locate W″, the distance 18° 19° and 20°, Fig. 2, is measured from W[1] along the line W W, Fig. 5. Five points are shown to locate the curve 9[2] W″ T[1] Y″ and 10[2] and, although three points would be quite sufficient, the number is left to the option of the reader. If three points are chosen it will be then only necessary to construct the cross sectional view through X X in Fig. 2.

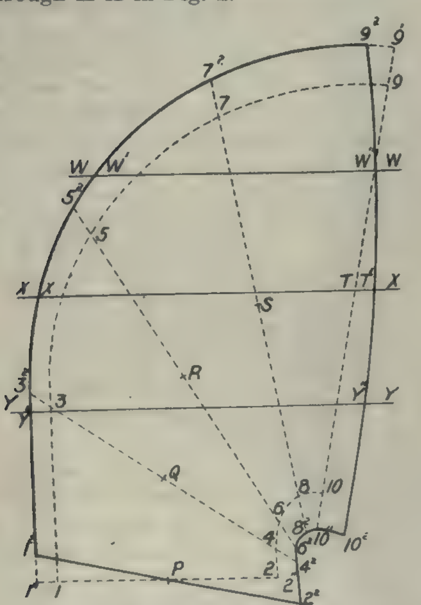


FIG. 5. DEVELOPMENT OF TEMPLETS FOR SIDE SHEETS.

The heavy lines in Fig. 5 show outline of the templet, minus the laps, for the side sheet.

Sets or gauges of the sections of the various planes will be used for trying out the templets, during the process of hollowing or blocking out.

The continuation of the cowl below the line A B is a straight cylinder and is developed as such. This cylindrical course is, of course, fitted inside the cowl for water-shed purposes, using the line A B as the girth seam line.

COMMERCIAL TRAINING FOR STEEL PLANT MANAGERS.

IN a communication to the "Ironmonger," dealing with the commercial training of steel plant managers, E. Griffiths, M.I.Mech.E., Liverpool, England, says it is quite appropriate to advise British steel makers to modernise their plants so as to be able to reap the full advantage of the present opportunity of securing the world's markets, but the mere modernisation of plants is not sufficient, as commercial success must, after all, depend on the calibre of the men who run the plant.

The necessity of commercial training for engineers on the basis that to sell machinery successfully it is necessary for the salesman thoroughly to understand the product he is selling, applies equally, if not more imperatively, to the modern steel trade, where, by the introduction of small percentages of various alloys, the metal can be made adaptable to such varied uses. Therefore our steel works should be manned by a well-trained commercial technical staff, and controlled by men of initiative and ambition, who, to a sound basis training in engineering and the various branches of iron and steel manufacture, add a sound practical commercial and financial knowledge.

Profitable Business Getting.

The success of a steel company does not lie in the possession of a fine plant or highly technical staff, as without business these cannot be profitably employed. The fundamental point in all trades is the making of profits, and in the atmosphere of a general meeting of shareholders, who know little, and care less, about the technicalities of the particular industry their money is invested in, it is of little use for a chairman to point out that the collieries are admirably equipped, the coal washeries up-to-date, or that the coke ovens are of the latest type, fitted with highly efficient sulphate and benzol plant, or that the coke burden of the blast furnaces has been decreased by use of desiccated blast, or that the latest mixed pressure turbines are used for blowing purposes, utilizing the exhaust steam from the mill engines, or that the open-hearth and Bessemer plants are second to none, unless he can at the same time announce a satisfactory dividend.

Now that the opportunity of securing a large proportion of the world's trade has unexpectedly arrived, there is no time to train such men; but would it not be possible to secure the services of men who have had a good technical training in steel works and engineering in their early days, and who have since branched out into commerce and learnt the art of technical salesmanship, together with the equally essential science of financing a business? Such men have the power to utilize their technical knowledge to its fullest advantage on the market, and, all things being equal, they are most likely to be able to make an otherwise satisfactory plant supply that one requirement of the modern shareholder—dividends.

POWER OF WINDMILLS.

THE following table and other data compiled by the "Electric Review," show the horse-power which can theoretically be realized from a 28 ft. wheel exposed to winds of various velocities:

Wind M.P.H.	Horse Power.
2.25	0.04
6.7	1.1
11.2	5.0
15.7	13.0
22.5	409
33.5	351
45.0	205
67.0	1,080

The power available should increase with the cube of the wind velocity (since the kinetic energy of the air particles increases with the square of their velocity and the number of them striking the wheel blades per second increases in direct proportion to the wind velocity). It is not practicable to construct a mill which will use with equal efficiency a light breeze and a strong wind, hence the curvature and setting of the blades should be such that the mill works most efficiently when exposed to a wind of the velocity generally prevailing in the district.

Breezes of eight to 15 m.p.h. are much more common than 20 m.p.h., hence it is generally advisable to employ a very light wheel which will start work in a 3.5 m.p.h. wind, and which can still be used when the wind rises to 10 m.p.h. Such a wheel could not be exposed fully to a 30 m.p.h. wind and, for safety, a device should be mounted on the main wheel so that when the wind pressure exceeds a certain limit the inclination of the blades is changed, against the control of a spring, in such a manner as to reduce the effective area exposed to the wind. The control springs may conveniently be set so that they come into operation when the wind velocity exceeds 16 m.p.h.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

AN ELEMENTARY STUDY OF RIVETED JOINTS.

RIVETING, at present, forms our only method of fastening steel plates together in the construction of steam boilers. The design of the riveted joint should be such as to secure the maximum aggregate strength. To accomplish this it should be equally strong in its several parts. That is, the shearing strength of the rivets should be equal to the tensile strength of the plate, and other possible methods of failure should be equally well balanced.

The rivets used in boiler work have, in general, two types of heads—the conical and round. The base of the former is usually made equal to twice the diameter of the rivet, and its height, three-quarters of the diameter. The base of the round head is made 1.7 times and the height 0.6 times the diameter. The distance from the centre of the rivet to the edge of the plate should be one and one-half times the rivet diameter, and the distance between centres of the rivets is known as the pitch.

Plates may be connected by lap joints or butt joints, and each may have one or several rows of rivets. A butt joint with a single cover plate should have the cover plate thickness equal to 1⅛ times the plate thickness. In the case of double butt straps, the thickness of each is made ⅝ of the thickness of the boiler shell. Longitudinal boiler seams are subjected to twice as great a stress as the ring seams, and hence have twice as many rows of rivets.

Riveted joints may fail in four separte ways: (1) The plate may fail in tension along the line of the rivets. (2) The rivets may fail by shearing. In the case of double cover plates this must take place at two points or the rivets are in double shear. (3) The rivet or the plate in front of the rivet may fail by crushing. (4) The plate in front of the rivet may shear out.

The **efficiency** of the joint is the strength of the joint compared to that of the unpunched plate. Thus, if the tensile strength of the plate is 64,000 pounds per square inch and a joint of ½-inch plate will stand 24,000 pounds per lineal inch, the efficiency of the joint is $\frac{24,000}{64,000} \times 2 = \frac{3}{4} = 75$ per cent.

This percentage can be greatly increased by increasing the pitch of the rivets and the number of rows.

Question.—What would be the shearing strength of a ¾-inch rivet?

Answer.—Cross sectional area of a ¾ rivet is $.75 \times .75 \times .7854 = .44179$ sq. inches.

Shearing strength of rivet steel is 50,000 pounds per square inch. Shearing strength of a ¾-inch rivet is then $.44179 \times 50,000 = 22,089$ pounds.

* * *

Question.—Using a safety factor of 6, and assuming the efficiency of the joint to be 65 per cent., what should be the thickness of a boiler shell plate for a boiler diameter of 54 inches and a steam pressure of 100 pounds per square inch?

Answer.—Total working pressure on one lineal inch of cross section is $54 \times 100 = 5,400$ pounds. This is resisted by two thicknesses of boiler plate. Ultimate tensile strength of boiler plate is 54,000 pounds per square inch. For a joint of 65 per cent. efficiency and a safety factor of 6, this becomes $\frac{54,000}{6} \times \frac{75}{100} = 6,750$ pounds per sq. in.

Load on a single thickness of plate 1 inch long $= \frac{5,400}{2} = 2,700$ pounds. Thickness of plate required $= \frac{27,000}{6,750} = .4$ inch, or, say, 7-16-inch plate.

* * *

Question.—What would be the approximate efficiency of a single riveted lap joint of good design, the pitch of the rivets being 4 inches and 1 inch rivets being used?

Answer.—It is assumed that the joint is equally strong in every way. The size of the hole punched in the plate will be 1 1-16 inch. In every 4 inches of length, 1 1-16 inch is punched out. Strength of plate after being punched is, therefore, $\frac{4-1\ 1\text{-}16}{4}$ of the original plate.

Efficiency, then, is $\frac{2\ 15\text{-}16}{4} = \frac{2.9375}{4} =$ 73.4 per cent.

* * *

Question.—In the above example, if ⅝-inch plate be used, would the joint fail by shearing off the rivets or tearing off the plate?

Answer.—Tensile strength of boiler steel is 54,000 pounds per sq. inch. The length of plate supported by one rivet is 4—1 1-16 = 2 15-16 in.

Cross sectional area of this is ⅝ × 2 15-16 = 1.835 sq. in.

Total strength in tension $= 54,000 \times 1.875 = 101,250$ pounds.

Shearing strength of rivet steel = 50,000 pounds per sq. in. Shearing area of 1 inch rivet $= 1 \times 1 \times .7854 = .7854$ sq. in. Shearing strength of a 1 inch rivet is, therefore, $.7854 \times 50,000 = 39,270$ pounds.

The plating of the joint is then $\frac{101,250}{39,270} = 2.58$ times as strong as the riveting. The joint is not well designed.

* * *

Question.—In the above problem what would be the effect of triple riveting and increasing the pitch from 4 to 6 inches?

Answer.—The length of unpunched plate per rivet in the front row = 6—1 1-16 = 4 15-16 inch.

The cross sectional area of this is 4 15-16 × ⅝ = 3.08 sq. in., and its tensile strength is $3.08 \times 54,000 = 166,320$ pounds.

This amount of plate is sustained by three rivets, the shearing strength of which is $.7854 \times 3 \times 50,000 = 117,810$ pounds.

The joint is still $\frac{166,320}{117,810} = 1.41$ times as strong through the plate as through the rivets.

* * *

Question.—Two pieces fastened together by a 1 inch rivet are so loaded that the rivet is stressed in tension. If the rivet head be considered as strong as the body of the rivet and is conical in shape, will the rivet fail in tension or by shearing off the head?

Answer.—The height of the cone head would be ¾ inch, and its diameter at the base would be 2 inches. The thickness at the shearing point would be ⅜ inch. Shearing area then is $1 \times 3.1416 \times ⅜$.

Shearing strength $= 1 \times 3.1416 \times .375 \times 50,000 = 58,509$ pounds.

Tensile strength $= 1 \times 1 \times .7854 \times 54,000 = 42,411$ pounds.

The rivet then is approximately 40 per cent. stronger in tension than in shearing through the head.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

WILLMARTH RADIAL DRILL.

THE Willmarth Tool Works, Cleveland, Ohio, are placing upon the market the radial drill illustrated herewith. The most prominent feature of this machine is in the manner of moving the head and arm for locating holes. The head rotates about a large circular bearing on the arm, and the arm rotates about the column as in the usual type. This produces a double-swiveling motion, so that any hole within the capacity of the machine may be readily located. A self-locking spiral gear and rack are provided for moving the head.

The bearing of the head on the arm is 17 ins. in diameter, and is provided with an annular ring inside for holding it central, and a heavy pivot bolt for holding the two together. A powerful eccentric clamp locks the head solidly to the arm, making substantially one piece. The column is of the post and sleeve type. The post has a large and heavy lower portion, and extends up to the top member, which is securely bolted to it, making a braced construction, and adding materially to the stiffness. The column sleeve telescopes the post, and has bearings both top and bottom, also a large ball thrust bearing at the bottom end, thereby rendering easy the swinging of the arm. The sleeve has a powerful binding clamp at its lower end which, when tightened, produces the ffect of a solid column. The arm is very rigid, of cylindrical box section and heavily ribbed on the inside. It is elevated or lowered by means of gearing at the top through a coarse pitch screw, hung on ball bearings. There are eight changes of speed, from 35 to 375 r.p.m., arranged in geometrical progression. Four changes are obtained by the cone pulleys, and four more by the back gearing, which is provided in the spindle driving gears.

The tapping mechanism is obtained by a jack shaft in the head, running at high speed, and drives through powerful ring clutches, which are self adjusting, and which are operated by means of a lever in front of the machine, enabling the workman to easily start, stop or reverse the spindle. The spindle of special steel, is accurately ground and is provided with an ample ball thrust bearing. It has a No. 5 Morse taper hole, is 3¼ ins. in diameter at its large end and 1¾ ins. at its smallest section.

The feeding mechanism is composed of a selective gear box and its gearing, which drives a worm and worm gear, this in turn driving the feeding pinion. Six changes of feed are provided, ranging from .006 ins. to .027 ins per revolution of the spindle. These are instantly avoidable by operating the dial on the front of the feed box. A quick return hand wheel is attached to the feed pinion shaft, and the engagement of the worm to it is made by means of a friction ring controlled by a nut in front of the hand wheel. Both depth gauge and automatic trip are incorporated in the feed mechanism.

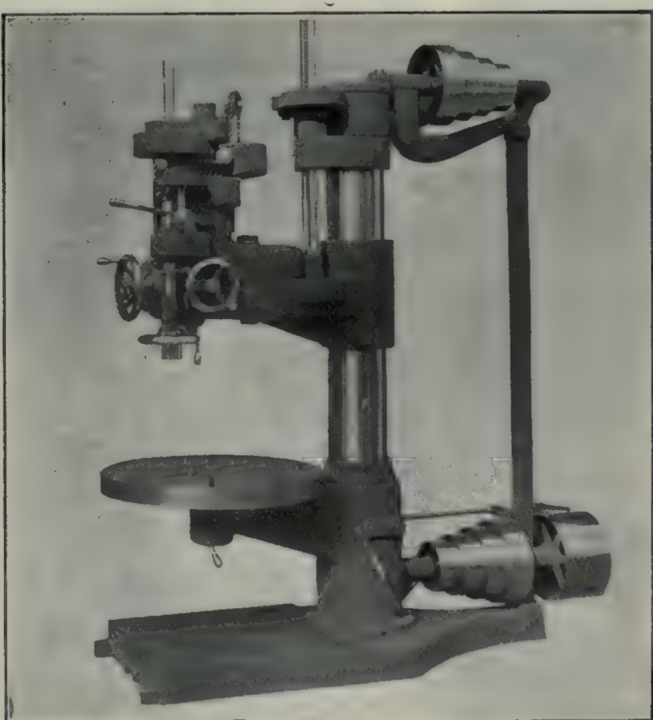
*The bearings throughout are bushed with high grade special bearing bronze,, and great care is exercised to provide ample oiling facilities. No cast iron gears whatever are used in this machine, these being of steel, bronze or a specially high grade semi-steel. All gears are fully guarded. The machine is regularly provided with the round table shown, but can be supplied with any style desired on special order. The principal dimensions of the drill are as follows: —Drills to the centre of a 48¾ in. circle. Greatest distance from spindle to base is 52½ ins., and to table 27 ins.

Vertical traverse of spindle is 11¼ ins., and of arm on column 28 ins.

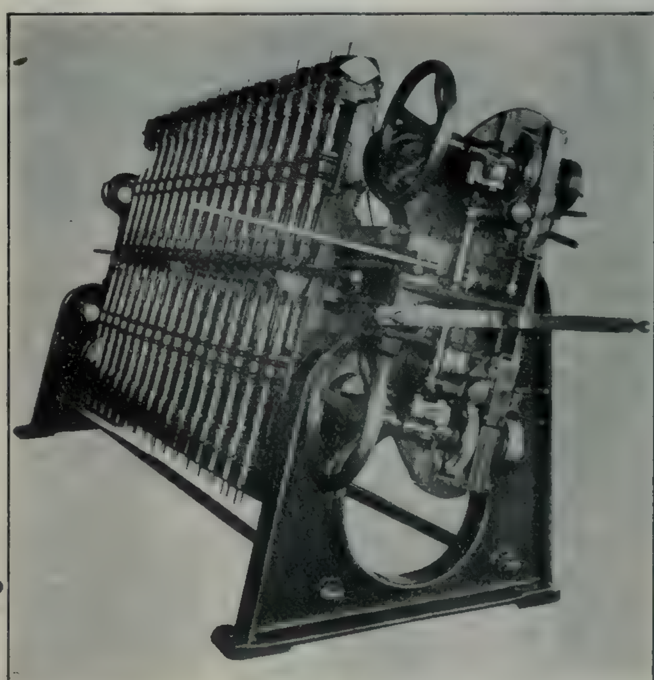
Height of machine is 96 ins., and weight 3,500 pounds.

NEW TYPE GANG-DRILLING MACHINE.

A new type of gang-drilling machine has recently been designed by the Valley City Machine Works, Grand Rapids, Mich. The machines are especially intended for drilling holes in pipe, and drill the opposite walls at the same time. The method of driving can be readily seen.

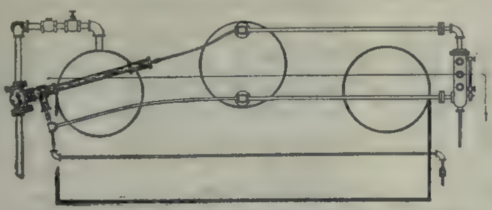


WILLMARTH RADIAL DRILL.



NEW TYPE GANG DRILLING MACHINE.

The machine consists essentially of a rail supported by as many legs as necessary. The rail carries the necessary units of drill spindle brackets which can be varied to suit the work. The rail is



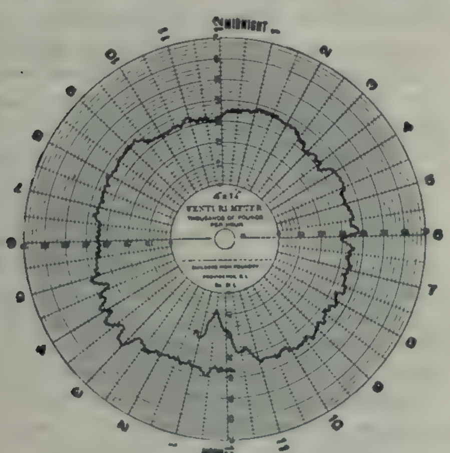
METHOD OF INSTALLING McDONOUGH FEED WATER REGULATOR.

set on an angle which enables the operator to handle the work with the least manual effort. The rail also carries the self-centering clamping jaws which are operated by the splined shaft, worm gears and rack and pinion. It will be seen that all spindles are adjustable both as to centre distance and drill lengths.

On the four spindle drill, which is twenty feet long, the feed is by hand lever at left end of machine, and on the thirty-four spindle drill, a power feed with automatic stop is provided for each gang of spindles. A sliding movement to the clamping jaws is imparted by the horizontal lever at right, by which the work can be moved longitudinally to different positions or stops for drilling any number of holes. The closest centre distance with clamps is 4¾ inches. The ten-foot machine weighs about six thousand pounds, and occupies a floor space of four by fourteen feet.

AUTOMATIC FEED WATER REGULATOR.

THE automatic feed water regulator here described and illustrated, is manufactured by the McDonough Automatic Regulator Co., of Detroit, Mich. It is of the thermostatically controlled type, the main purpose of the design being to not only secure a continuous feed, but positive automatic control of same, so that the feed will vary with the boiler load and maintain a water level within limits best suited for constant boiler capacity, efficiency and uniformity of operating conditions. The regulator in operation it is claimed will maintain a continuous feed proportional to the evaporation, and for light and uniformly varying loads, a constant water level. On the other hand, for sudden increases of load and resulting rapid drop in water level, the regulator valve does not open suddenly to admit a large quantity of water into the boiler, there being a time element in the expansion of the tubes operating the valve which uniformly increases the feed, permitting the immediate furnace heat to be used for evaporating water and not heating cold feed. In this way the maximum capacity of the boiler, with greater uniformity of furnace conditions is maintained and boiler strains are avoided.



VENTURI METER CHART SHOWING REGULATION OF FEED ON TWO BOILERS EQUIPPED WITH McDONOUGH REGULATORS.

McDONOUGH FEED WATER REGULATOR COMPLETE.

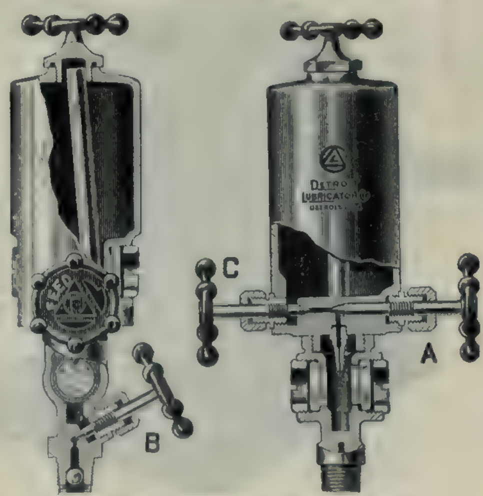
The regulator consists of a special feed valve, two headers and two expansion tubes connected in parallel through a rigid linkage to the feed valve stem. The use of two expansion tubes doubles the power of expansion and contraction and the levers transmit the motion to the feed valve in a ratio of 5 to 1. The turnbuckle and pointer indicator permit very accurate adjustment of the valve and further, the pointer indicator shows at each instant the position of the valve while the regulator is in operation. The regulator is installed in an inclined position, wholly supported by the feed piping and with the connections made to the water column as shown. In operation, the lower ends of the tubes are filled with water and the upper with steam. As the water falls or rises in the boiler, it correspondingly falls or rises in the regulator tubes, presenting a greater or less area of the tube surface to the hot steam, causing them to expand and contract accordingly. The inclined position of the regulator gives the greatest variation in exposed tube surface for a given variation in water level and the greatest sensitiveness to variations in load.

The accompanying Venturi meter chart, taken on two boilers equipped with McDonough automatic regulators at the plant of the Quaker Oats Co., Akron, Ohio, indicates the uniform and constant feeding characterists of this apparatus which goes under the trade name of the "World's Best."

AMMONIA CYLINDER LUBRICATOR.

THE Detroit "600" Lubricator, which is manufactured by the Canadian Detroit Lubricator Co. of Walkerville, Ont., is designed and constructed especially for use on ammonia cylinders. It may be attached to the ammonia cylinder or to the pipe line leading to same. Lubricators for steam or air cylinders are constructed of brass, but lubricators constructed entirely of brass are not satisfactory on ammonia cylinders because of the excessive corrosion, consequently the "600" Detroit is constructed of material that will resist the action of the ammonia fumes. This lubricator is easily operated, and gives constant lubrication to the cylinder under every condition of service.

The lubricator is substantially made so as to withstand excessive pressures, vibration and rough usage. It has bulls-



DETROIT AMMONIA LUBRICATOR.

eye sight feed and gauge glasses which are easily kept tight and not readily broken. The filler plug and valves are provided with metal handles.

The lubricator may be connected di-

rect to the cylinder, and using, if desired, a short piece of pipe and elbow. No separate valve is used, as the valve B in the support post cuts off the lubricator from the cylinder when it is desired to repack the glasses, clean the

DETROIT AMMONIA LUBRICATOR.

lubricator, etc. The valve C controls the admission of oil to the oil passages, and should be used to operate the lubricator, making it unnecessary to change the adjustment of valve A, which need not be disturbed after once being properly regulated.

LARGE SLIP-RING INDUCTION MOTORS.

THE Westinghouse Electric & Mfg. Co. has recently placed on the market a new line of large slip-ring induction motors for continuous service, such as driving pumps, blowers, compressors, hoists and other machinery requiring heavy starting torque.

One of the chief characteristics of these motors is great strength. The

FIG. 1—NEW SLIP RING INDUCTION MOTOR.

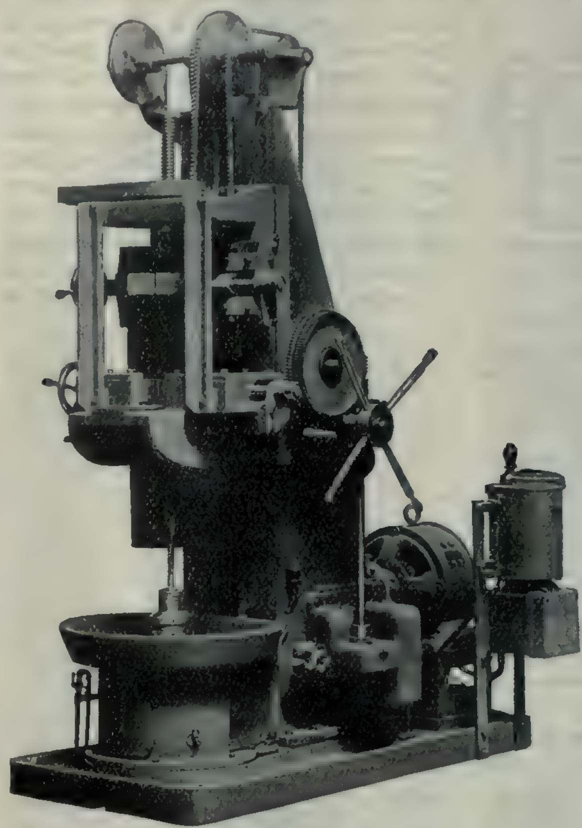
frame is massive, the bearings and shaft extra large, and the windings are securely braced against vibration. The bearings are dustproof and rest on three machined seats, a construction that has been found to be the best practice in steel mill service.

All coils are form wound and completely insulated to ground before being placed in the slots. The stator slots are straight open; those of the rotor have an overhanging lip which assists in holding the coils in place, but the coils can be removed and replaced without bending as readily as with straight open slots. The shaft can be removed without disturbing the rotor winding.

The bearing shell may be removed and replaced without taking off the lower

FIG. 2—NEW SLIP RING INDUCTION MOTOR.

half of the bearing bracket. The brushes are readily accessible, as may be seen in Fig. 2.



INVERTED TYPE DRILLING MACHINE.

AN INVERTED DRILL.

THE interesting feature of the drill shown in the illustration is that it drills from the bottom upwards instead of vice versa, which is the usual practice. This machine is designed for drilling 90 point carbon billets, 20 inches long and 4 or 5 inches in diameter. The advantage of drilling them in an inverted position is that the driving spindle is held rigid at the bottom of the machine and vibration is reduced to a minimum on the drill which is of small size and 24 inches long.

The head of the drill is really a jig for holding the pieces, and two sets of jaws are provided to grip the upper and lower parts of the billet and insure centering. There is also a jack-screw for holding the billet in place.

The machine is manufactured by the Foote-Burt Co., Cleveland, Ohio, and is driven by an $8\frac{1}{2}$ h.p. Westinghouse Electric Co. direct-current adjustable speed motor, 800 to 1,600 r.p.m. controlled by a Westinghouse drum controller.

TRANSMISSION LINE INSULATORS.

THE color of insulators for transmission lines is important. Most engineers prefer brown, green, or neutral tints as beiess conspicuous than white, and therefore less likely to attract the attention of stone throwers, etc. White insulators have, however, the advantage of more readily disclosing where a breakdown has occurred. On lines comprising two or more circuits it is sometimes advantageous to use insulators of different colors for each circuit in order to prevent mistakes and danger to linesmen.

All insulators should be made of the highest grade porcelain which has been vitrified throughout, and is absolutely non-absorbent of moisture and free from flaws, cracks, or foreign matter. The coloring of insulators is given by the glaze, which must cover the entire surface, except the area where joints are made, and must be free from crazing, bubbles, cracks, etc. On completion, insulators should be tested both electrically and mechanically.

Hugh Davidson, of Goderich, Ont., has been appointed captain of the steamer Meaford. Mr. Davidson is 25 years of age, and one of the youngest captains on the Great Lakes.

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Vol. XIII. JANUARY 28, 1915 No. 4

PRINCIPAL CONTENTS.

SHIPBUILDING A NATIONAL ASSET.

THE world's shipbuilding and marine engineering output statistics recently available for the year 1914 form as usual both interesting and highly instructive reading, and we as Canadians should no longer be content to occupy the somewhat lowly place that the year after year figures of our production allocate to us. This twin industry is one which we have in the past almost wholly ignored, much less appreciated. We have become so accustomed to put all of our eggs into the one basket that any other began to appear wholly unnecessary, and to-day when shipbuilding and marine engineering are booming, and shipowners and Governments are making frantic efforts to add to their ocean fleets, we are caring for our unemployed by providing emergency works.

Setting aside the fact of her insular location, one prominent feature in Britain's business life has been so to establish and develop every known department of enterprise as to be able to give an equivalent return either in kind or service to those on whom she in numerous instances has had to be or is dependent. In the realm of shipbuilding and marine engineering, although at one and the same time a "Past and Present Grand Master," she has neither overlooked nor neglected other spheres of manufacturing or, more strictly speaking, other mechanical engineering enterprise, being in these respects at least a competitor worthy of the keenest.

We in Canada are more insular in our business attitude than is Britain in her geographical location, and too often lose sight of the fact that to give the world what it wants and needs we should be in a position to not only produce and manufacture, but produce, manufacture and own the vessel transportation to deliver. Our crops are no doubt quite a substantial asset and, just because we have so chosen to make them, are of considerable importance to us nationally, but we are familiar enough with the fickleness of our climate, or should be so to realize, that crop failures are not uncommon. We have not hesitated to cater to railroad transportation nor to establish industries bearing on the latter, yet how little have we done to establish or stimulate water transportation industries within our borders or on our seaboards.

Our mineral wealth, it is authoritatively stated, is so unbounded that developments which have already taken place may be classed as mere surface scratches. There still lies hidden, we are told, across the length and breadth of this Dominion, the raw material with which we may yet become a first-ranker in the manufacturing world. We have chosen in the past, however, to stake our very existence on our crops, and have conformed our manufactures to that end. We have saddled and burdened our country with two transcontinental railroads whose revenues will not meet expenses in the next 25 years, or perhaps longer, unless we come to our senses soon, when proper regulation of the original railroad and its spur development would have sufficed. Had a fraction of the expenditure on these fool-hardy enterprises been given to the establishment and stimulating of shipbuilding and marine engineering with their myriad accessory industries, there would have been fewer iron and steel plants idle and semi-idle to-day and less unemployment of men and equipment.

It is highly significant of the ensuing navigation season outlook, that the Lake Carriers' Association at their recent annual meeting decided to delay the start of their vessel operations until June 1, and it is equally significant of the undesirable position in which the United States finds itself to-day that, at least so far as its Government is concerned, it is out "flat-footed" to purchase all available vessels to build up its merchant marine. It has required this European War to bring home to that otherwise progressive country the fact that an outlet of their own is absolutely necessary to meet both ordinary and extraordinary contingencies.

Canada owes equally as much to steamships as to railroads for her development, although in recent years her Government and her citizens have forgotten the fact. Her shipbuilding too was once a factor in the world's commerce, but was engulfed when railroads and wheat became enthroned.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 40
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00
Hamilton, No. 1	18 00	17 00
Hamilton, No. 2	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 9 00
Copper, crucible	10 00	10 00
Copper, unch-bled, heavy	9 50	10 00
Copper wire, unch-bled	9 50	10 00
No. 1 machine compos'n	8 50	9 00
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00

Tea lead	3 00	3 00
Scrap zinc	3 25	4 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload	$15 00	$15 00
Electrolytic copper	14 75	14 75
Castings copper	14 50	14 50
Tin	38 00	36 50
Spelter	7 25	7 00
Lead	4 75	5 00
Antimony	18 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Jan. 8, 1915:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal
	Standard			
¼, ⅜ in.	65½	50½	....	....
½ in.	70½	59½	....	....
¾ to 1½ in.	75	65	....	....
2 in.	75	65	71	61
2½ to 4 in.	75	65	74½	64½
4½, 5, 6 in.	....	....	72½	62½
7, 8 10 in.	....	....	69	58
	X Strong	P. E.		
¼, ⅜ in.	58	48	....	....
½ in.	65½	55½	....	....
¾ to 1½ in.	69½	59½	....	....
2, 2½, 3 in.	70½	60½	....	....
2½ to 4 in.	....	....	67½	57½
4½, 5, 6 in.	....	....	67½	58½
7, 8 in.	....	....	60½	49½
	XX Strong	P. E.		
½ to 2 in.	44	34	....	....
2½ to 4 in.	....	....	44	34

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.68
Linseed oil, boiled, single bbls.	0.71
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 08
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 25, 1915—During the past week the volume of business moving has not shown any great increase over that of the week previous. This is, of course, due largely to the dull times which are always present at this season. There seems to be normal activity in the general lines of trade, although the railways are not purchasing as heavily as had been expected. The number of inquiries continue to increase and the amount of actual business being placed is also developing. The increasing number of inquiries goes to show that there is under consideration a certain volume of business which will be placed early in the spring.

The incessant demand for shells and war munitions has created a great deal of activity in those shops whose equipments enable them to handle such work economically. Further, the demand for turret lathes, grinders and other small machines used in their manufacture, has stimulated machine tool sales.

The pig iron markets remain rather dull, but in the metal market a marked activity prevails. A general stiffening in prices is noted, copper being particularly active.

The building trade will soon be in the market again for steel to enable firms to commence work on their spring contracts, while orders for steel forgings for war munitions and marine purposes are finding their way to Canadian firms more frequently of late.

The Steel Market

Although it was expected that the railways in the Central and Eastern States would place more or less extensive orders with the steel companies early in the year, such has not been the case. It is true, however, that they have placed a number of orders but these have not been as large as was expected. Canadian mills are receiving considerable business from Britain and have been kept busy filling same. The general situation has not changed since last week.

Pig Iron.

This branch of the trade remains very dull indeed and there seems very little prospect of early improvement. The

price still continues very low indeed. Virginia furnaces have booked orders for several hundred tons at $12.50 for No. 2 grade. However, in and around Buffalo, prices vary from $13 to $13.50 for delivery in the second quarter of 1915.

Machine Tools

This particular department remains exceedingly quiet on account largely of the reduction in all lines of manufacturing. The nature of the orders has changed from those in bulk to individual, the largest demands of the latter being for turret lathes and grinding machines. The supply business continues about the same.

Metals.

In the metal market considerable activity has been experienced during the past week. Everywhere prices have risen. It is, however, difficult to trace the reason for the advance in copper, but it is due, no doubt, to increased demand for metal. Evidently there will be no curtailment in the amount of shipping to Europe. Spelter also took a rise of one cent per pound, as also did tin. Throughout the whole metal market the tendency is for the price to stiffen. Regarding antimony, it is very necessary to emphasize the remarks of last week, supplies from Europe being unobtainable, while Russian interests have almost wholly monopolized the Japanese and Chinese output. Aluminum and lead are the least active of the metals, and although the prices have not changed, there is a marked tendency to stiffen.

Toronto, Ont, Jan. 26, 1915.—There has been little, if any, improvement in business this week, conditions generally being unchanged, with few indications of any substantial improvement in the immediate future. The situation, however, is not much below normal and is capable of quick recovery as soon as the outlook improves sufficiently to warrant a more progressive policy. Manufacturers are continuing their policy of retrenchment and the railways are restricting their operations. The latest Government contract for uniforms amounts to about four million dollars which, in addition to previous orders, is keeping a number of factories busy. There has been some development in the steel trade with regard to war orders but not sufficient to create much enthusiasm over the prospects of that industry. The Dominion Government returns show a decrease of twenty-two millions of dollars in the value of imports for December; on the other hand, there was an increase in the same month of two million dollars in the exports of manufactured goods. The balance of trade against Canada is gradually decreasing, December exports being six million dollars greater than the imports. This is a favorable feature, but would be more so if business were normal. There has been no decision handed down yet with regard to the proposed increase in freight rates and the tariff situation continues to be a subject of considerable interest among business people.

Conditions in the steel trade are much the same as last week; the volume of business is comparatively light, although orders for war materials are keeping some mills more or less busy. An adjustment has been made in the price for wrought iron pipe, the discounts being slightly higher. The scrap metal market is dull and prices unchanged; the same may be said of pig iron. There is a little better tone in the metal markets, copper, tin and spelter having advanced in price. There is considerable activity in machine tool circles on account of increased business in equipment for machining shrapnel shells.

> **CO-OPERATIVE—NOT COMPETITIVE.**
>
> **In his thesis on "German Methods in Commerce," issued by the Institute of Industry and Commerce, Sir William Ramsay, after urging strenuous war upon such methods, says that "Once the conquest is achieved, we should do well to remember that commerce should be co-operative, and not competitive; it being to our interest not only that we ourselves should prosper, but that others should also prosper; that, indeed, our own prosperity is bound up in the prosperity of our fellow creatures."**

Steel Trade.

There is little of importance to note in the iron and steel trade and conditions are generally quiet; not unusual at this time of the year. The building trade is as dull as ever and consequently there is little demand for structural shapes. There has been a little better demand for bar iron from manufacturing interests. A considerable amount of steel is being used in the manufacture of shell cases, and the demand continues to increase. There have been no price changes this week.

The steel trade in the States is showing greater activity, having somewhat improved since the beginning of the year. Mill operations show a gain this year of approximately 55 per cent. in the Pittsburgh district. The ferro-manganese situation is becoming more complicated on account of the action of the British Government in seeking to prevent the shipment from the States, except through London, of this alloy, or any products in which it might enter, to Germany or Austria. This applies to ferro-manganese originating from Great Britain. Prices are firm but unchanged, except billets, which have advanced slightly.

There has been a re-adjustment in the discounts of wrought iron pipe which will be found in our market quotations. The discounts which have recently gone into effect are from 1 to 3 per cent. higher. It is anticipated that there will be a further adjustment in prices on account of a possible change in the customs tariff. The new discounts, however, are in effect until further notice.

Pig Iron.

The market is quiet and uninteresting. The demand has improved somewhat, but buying still is light. Prices are unchanged.

Machine Tools.

The number of machine shops working on shell orders continues to increase and there is still considerable activity in machine tool circles. Local machinery houses are busy figuring on inquiries for equipments and some nice business has been booked with more in prospect. The situation is interesting and apparently will continue to be so for some time.

Supplies.

The demand for machine shop supplies is steady but light, with no change in prices except linseed oil, which has advanced 4 cents, the price of raw oil being now 68 cents and boiled 71 cents per gallon. The advance is accounted for by the high price of flax seed, and although the demand is light a further advance is anticipated shortly. Leather belting has not changed although a continued shortage of hides and heavy demand for leather is reported.

Metals.

Locally the demand for metals is light, but gradually improving. Prices in some cases are higher on account of strength in the primary market. Copper has advanced ¾c per pound, the strength of the market being attributed to the demand from Europe. Lake copper is being quoted at 15c per pound. The demand for tin is light but the market is firm and prices higher in London. The price locally has advanced ½c and tin is now being quoted at 36½c per pound. The spelter market is strong and prices continue on the up grade; heavy exports to London and improved domestic demand in the States are tending to stiffen the market. Spelter has

advanced ¾c, being now quoted at 7c per pound. The antimony market is strong on good demand but prices are unchanged at 18c per pound. Aluminum is unchanged at 22c per pound.

FREIGHT BILL SCRUTINY.

CANADIAN consignees in the district east of Port Arthur are advised by the Traffic Department of the Toronto Board of Trade to scrutinize their bills for freight shipped from points in the United States east of Buffalo and north of the Potomac River.

Under the decision of the Interstate Commerce Commission given on Dec. 16, 1914, in the "five per cent. case," railways in official classification territory, roughly speaking, east of Buffalo and north of the Potomac River, were allowed to increase their freight rates. The new rates were made effective from January 15, 1915, and by the tariffs of interested lines were extended to Canadian points east of Port Arthur. Supplements to those tariffs, however, were issued, postponing the advance, in so far as Canadian points were concerned, until February 15.

It appears, nevertheless, possibly through some misunderstanding, that the billing clerks of some of the American trunk lines have billed shipments to Toronto and other Canadian points at the increased rates. The Traffic Department of the Board of Trade, therefore, cautions consignees to examine their freight bills for shipments from the territory affected, and if overcharged to file claims for refunds.

WHEN THE WAR IS OVER.

WHEN the war is over we hope, says the Engineering Review, that some attempt will be made to give a comprehensive account of the part which British manufacturing power has played in the prosecution of defensive and offensive operations. If money is the sinews of war, engineering is the bone and muscle. This immense productive activity, however, has its dangers. It is apt to obscure the thought of what will happen when the military demand ceases as rapidly as it came into existence. That will be the really critical period; and now is the time when provision should be made for it.

Lloyd George has stated that the post-bellum period, when the world is suffering from the exhaustion of capital on the unproductive business of war, will bring the most serious industrial situation which this country has ever been called upon to face. In this statement he may be expressing a more gloomy view than most of us are inclined to share. Nevertheless, it is only everyday wisdom, in manufacturing as well as in military matters, to prepare for the worst that may happen. Our industries must, therefore, find time to consider, even in the midst of the rush of war orders, what is going to happen during the reaction after the war, and how they are going to deal with it.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Toronto, Ont.—The Polson's Ironworks will build an extension to the machine shop.

Wallaceburg, Ont.—The pumps of the waterworks system were successfully used for the first time on Jan. 20.

Berlin, Ont.—The Regal Automobile Co. propose to build an extension to their factory here. Mr. Nyberg is manager .

Fort William, Ont.—The Northern Engineering Co. are negotiating for a large order of shells from the Government. W. J. Ross is the manager.

Mount Brydges, Ont.—The village trustees have decided to take steps for fire protection. Underground concrete tanks will be built and electrically driven pumps installed.

Toronto, Ont.—Mayor Church informed the Board of Control on January 19 that the Exhibition Board had plans ready for a new machinery hall for the Exhibition grounds, and would ask an appropriation of $105,000.

Thorold, Ont.—The Exolon Company, makers of an artificial abrasive, propose to build another unit to their plant, to cost $20,000. The present buildings and equipment represent an expenditure of $130,000. C. J. Brockbank is manager.

Midland, Ont.—The steel plant formerly known as the Georgian Bay Engineering Works, which has been standing idle for nearly fifteen months, will resume operations. Drummond Brothers have leased the plant, and will fit it up for the manufacture of shrapnel shells. J. J. Drummond is manager of the company.

Chatham, Ont.—The City Council is negotiating with the Augustine Automatic Rotary Engine Co. for the sale of the Defiance plant on Lacroix Street. The company has made an offer to the Council, which has been endorsed by the Board of Trade, and the entire matter has been placed in the hands of the industrial committee.

Fort William, Ont.—The National Tube Co. is making application for the return of one-half of their deposit of $50,000 with the city, on the ground that they have carried out the terms of their agreement by spending the required amount of money on the plant and putting it in operation, though only for a week. The balance of the money is to be returned to them on their completing a full year's operation.

Electrical

Hamilton, Ont.—E. T. Sifton, chief Hydro engineer, is now preparing plans and estimates of the cost of introducing a municipal telephone system, which will include the Hydro, the Board of Education and Works Department, and other civic departments.

Lucan, Ont.—Hydro was turned on here on Jan. 22, and following the interesting ceremony, a large public meeting was held in Stanley's opera house, where addresses were heard from Engineers Kaster and Jeffrey, of the Ontario Hydro-Electric Commission.

St. Thomas, Ont.—The work of erecting an extension to the Hydro-Electric power station, north of here, as a substation in connection with the electrification of the London & Port Stanley Railway, has been commenced. The extension will be 44 x 72 feet. Hyatt Bros., of London, have the contract.

Toronto, Ont.—Huntsville has passed all the necessary by-laws for a Hydro plant on the Muskoka River, and the agitation is causing a stir in Bracebridge, which has had a local system for some time, but where a by-law to augment the power facilities was defeated recently.

General Industrial

Kincardine, Ont.—The by-law passed last Friday to authorize a loan of $15,000 to the W. Mitchell Co. knitting factory.

Indian Head, Sask.—The elevator of the Winnipeg Elevator Co. here was burned to the ground on Jan. 22. It is a total loss, together with 30,000 bushels of grain.

Galt, Ont.—Messrs. Lamers and J. A. Parsons, of the Vogue Hat Co., Montreal, have been here looking for a location to establish a factory to manufacture fur, felt and straw hats.

Redcliff, Alta.—It is reported that Mr. McHenry proposes establishing a grist mill and elevator in Redcliff. Plans and specifications have been prepared for a 200-barrel mill to cost in the neighborhood of $20,000.

Sherbrooke, Que.—The Board of Trade is negotiating with a firm in the United States who propose establishing in Sherbrooke a factory for making silk hosiery, gloves, etc. An agreement has been signed by both the city and the company.

Camrose, Alta.—W. Mortimer has decided to install a flour mill in the New Norway district. The machinery is already on the way, and it is expected that the mill will be in operation soon. The plant will be of 40-barrel per day capacity.

Hamilton, Ont.—Industrial Commissioner Marsh, in his annual report to the Board of Control, announced that the prospects for securing new industries for Hamilton were particularly bright. He had negotiations under way with ten concerns which had about decided to establish branches.

Municipal

Sarnia, Ont.—The village of Point Edward, near here, will buy fire-fighting apparatus.

Brandon, Man.—The council are in the market for new equipment for the fire department.

Ottawa, Ont.—A by-law has been approved in connection with the proposed civic abattoir to cost $100,000.

Kenora, Ont.—T. Aird Murray, consulting engineer, Toronto, has the work in hand for the proposed sewage disposal plant.

St. Catharines, Ont.—The City Council are considering the installation of an incinerator plant. W. P. Near is the engineer.

Hamilton, Ont.—Chief Ten Eyck, in his annual report of the fire department, recommends the installation of an entire new fire alarm system, and that ten new alarm boxes should be installed at once.

Regina, Sask.—The City Commissioners have recommended the purchase of a low tension switchboard for the new power house. The tender of $747 submitted by the Mainer Electric Co., of this city, will probably be accepted.

Aylmer, Que. — The ratepayers on January 19 voted down the by-law to install a filtration plant, but carried the by-law to extend the intake pipe.

Point Grey, B.C.—The Council have authorized the acceptance of delivery of the new steam pump for the fire department. The engine will cost $12,200.

North Bay, Ont.—At a meeting of the Town Council it was decided to submit a by-law to the electors to raise $60,000 for road and street improvements during 1915.

Kingston, Ont.—Hugh McBratney was elected chairman of the Kingston Board of Health on January 21. The board is considering the installation of an incinerator for garbage disposal.

London, Ont.—The village of Ilderton, 10 miles north of here, decided to join the Hydro-Electric Union on Jan. 25, by carrying a hydro-enabling by-law by a majority of 22. A small vote was cast.

Hamilton, Ont.—The National Gas Co., which under its agreement with the city was to have laid seven miles of pipe last year, and laid but three and a half miles, according to the city inspector's report, will be asked to appear before the board and state why they failed to fulfil their agreement.

Brockville, Ont.—On the recommendation of the district medical officer of health, the provincial sanitary engineer, F. A. Dallyn, Toronto, has been requested to visit Brockville to make a report on the town's water supply, which is thought to be the cause of the outbreak of typhoid fever.

Ottawa, Ont.—The council will submit the amended report of the Board of Trade to the Provincial Board of Health. The report proposes the construction of an overland pipe to Lemieux Island to increase the water supply, as shown on a plan of J. B. MacRae, engineer. All reference to filtration was eliminated.

Aylmer, Que.—The solution of the water question is still in doubt. Although the people passed the by-law for the extension of the intake pipe, the Provincial Board of Health has on several occasions stated that they would not accept this as a solution of the water problem. It is expected that the Board of Health will order the town to install a filtration plant.

Goderich, Ont.—The town is having trouble with its water supply again. The water supply is taken from the lake, and the difficulty has been to get the water pure and free from sewage contamination. The intake crib has been changed several times, and the pipes extended further out in the lake at a great expense to the town; and now another change, estimated to cost about $38,000, is being agitated.

Winnipeg, Man.—At a meeting of the Transcona council on Jan. 21, the agreement between the town and J. H. Kern, Sr., of Moose Jaw, relative to the building of an electric line from Winnipeg to the town was annulled, and E. Baily Fisher was appointed to bring the matter before the attention of Public Utilities Commissioner Robson for his official sanction. The agreement to build the line was entered into last summer, but it is understood that it is impossible to finance the project at the present time.

New Incorporations

Perham & Co. has been incorporated at Ottawa, Ont., with a capital of $50,000 to operate stone quarries, etc., at Montreal, Que. Incorporators: E. D. Maguire, D. F. Carter and R. E. O'Neil, all of Montreal, Que.

The Wiarton Woolen and Knitting Mills, Ltd., have been incorporated at Toronto with a capital of $50,000 to manufacture woolen goods at Wiarton, Ont. Provisional directors include T. H. Barton and C. B. Anderson.

Leather Canvas Textile Mfg. Co. has been incorporated at Ottawa, Ont., with a capital of $50,000 to manufacture leather and canvas goods at Ottawa, Ont. Incorporators: R. G. Code, E. F. Burritt and J. R. Osborne, all of Ottawa, Ont.

Ingersoll Machine Co. has been incorporated at Ottawa, Ont., with a capital of $40,000 to carry on the business of electrical and mechanical engineers at Ingersoll, Ont. Incorporators: L. A. David, L. E. D. Mailhiot and S. H. R. Bush, all of Montreal, Que.

The Auto Heater Co. has been incorporated at Toronto, Ont., with a capital of $50,000 to manufacture automobile heaters and heaters for public or private conveyances at Toronto, Ont. Incorporators: J. R. L. Starr, Grant Cooer and R. P. Locke, all of Toronto, Ont.

Webster Construction Co. has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on business as contractors and engineers at London, Ont. Incorporators: W. G. Webster, J. E. Skallman and A. B. Webster, all of London, Ont.

Winnipeg Aqueduct Construction Co. has been incorporated at Ottawa, Ont., with a capital of $250,000, to take over the Northern Construction Co. and the Carter Halls-Aldinger Co., also certain contracts entered into by the two companies with the Greater Winnipeg Water District relating to the construction of an aqueduct for the said district. Incorporators—C. V. Cummings, F. E. Halls and Wm. H. Carter, all of Winnipeg, Man.

Tenders

Toronto, Ont.—The Canadian Electrical Association are in the market for large quantities of lamps, transformers, meters and wire. For specifications and forms of tender, etc., apply to Alan Sullivan, sec.-treasurer, 10 Adelaide Street East.

Toronto, Ont.—William R. Perrin & Co., 530 King street east, makers of abattoir equipment are selling their plant and buildings. Tenders will be received up to Feb. 3. Full particulars may be obtained from E. R. C. Clarkson & Sons, Toronto.

Calgary, Alta.—Tenders will be received up to February 12, 1915, for the furnishings and erecting of steel superstructure for Louise Bridge at 9th St. West. Plans, specifications and information may be obtained from the city engineer's office, upon making a deposit of $5.

Toronto, Ont.—Tenders will be received at this department until Monday, February 1, 1915, for the electric fixtures required for new Government House, Rosedale, Toronto. Plans and specifications can be seen at this department. H. F. MacNaughten, secretary, Public Works Department.

Toronto, Ont. — Tenders will be received by the chairman of the Board of Control, City Hall, up to Tuesday, Feb. 2, 1915, for the supply of cast iron special castings. Specifications and tender form for the foregoing may be obtained upon application at Room 12, purchasing and accounting section, of the Department of Works, City Hall.

Toronto, Ont.—Tenders will be received up to Tuesday, February 2, 1915, for the supply and delivery to the Street Cleaning Department of 100 (more or less) loose paper can receptacles, as may be required. Specifications may be seen and form of tender obtained, together with all information relative thereto, at the office of the Street Cleaning Department, City Hall, Toronto.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, up to Tuesday, February 16,

The Ford-Smith Machine Company

20" Water Tool Grinder

Quality Grinders

"KEEP SHARP"

These words stamped on milling cutters apply equally to all tools. To get *results*, tools must be kept in A1 condition. How is your shop equipped in this respect?

We build tool grinders from 12" by 2" wheels up to 36" x 4". Think it over and get our catalogue to-day.

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Important Message to Manufacturers of Shrapnel Cases

We can furnish you with Collapsing Taps that will do the tapping operations. We realize the exacting requirements necessary to pass inspection and have furnished

MURCHEY TAPS

that are now doing this same work.

You know that collapsing taps cut tapping costs in two, but do you know that they will do the work better than solid taps and also eliminate stripped threads and consequent rejections?

We want to get in touch with every Canadian manufacturer of these parts, and will be glad to send representative to show what we have done for others.

All Murchey Tools are Absolutely Guaranteed.

Murchey Machine & Tool Company
34 PORTER STREET, DETROIT, MICHIGAN

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1915, for supply and installation of furnaces and appurtenances for refuse incinerating plant. Specifications and tender form for the foregoing may be obtained upon application at the office of the Street Commissioner, Department of Street Cleaning, City Hall, Toronto.

Trade Gossip

The Frick Co., Inc., Waynesboro, Pa., are distributing among their friends a month-by-month calendar printed in bold type and two colors.

Alexander Elder, the founder of the Elder-Dempster Steamship Line, died at Southport, England, on January 25.

The Polson Ironworks, Ltd., Toronto, have received an order for shrapnel shells from the Government.

Vancouver, B.C.—The Vancouver and Victoria Boards of Trade have sent a petition to the Provincial Government asking for the appointment of a British Columbia trade commissioner for the West Indies.

Berlin, Ont.—At a representative and largely-attended meeting of manufacturers of Waterloo County here on Jan. 21, it was decided to energetically get after export trade, particularly in lines which were formerly supplied by Germany and Austria.

Winnipeg, Man.—The executive of the International Association of Machinists decided on January 21 to approach the Dominion Government with the suggestion that Canada send some of her surplus mechanics to the Old Country, there to be engaged in the production of munitions of war.

The Turbine Equipment Co, Toronto, has been awarded a contract by the Ver Mehr Engineering Co., Toronto, for three De Laval 36 in. double suction centrifugal pumps, each direct connected to a 300 h.p. motor. The capacity of each unit will be 36 million Imperial gallons per day and they will be used in connection with the Toronto Island filtration extension.

Ottawa, Ont.—The Toronto Terminal Railway Co. is applying to Parliament for legislation increasing the present limit of the company's bonding powers and also empowering it to acquire lands for and to construct, maintain and operate in Toronto freight and other facilities "in such manner and to such extent as the business of the company renders expedient."

War Orders.—An order from the Imperial Government for the partial manufacture of military uniforms, valued at $4,000,000, has been let to Canadian firms. The order calls for the production of 500,000 coats and trousers. Frederick Stobart, purchasing agent for the Imperial Government, also announces the ordering of one million canvas mess tin covers from Montreal, Ottawa and Winnipeg firms.

Lake Superior Corporation. — A change has taken place in connection with the Lake Superior Corporation administration, by which J. Frater Taylor resigns, and Thomas Gibson, of Toronto, takes the office. This was effected at a meeting of the Board held recently in Montreal. Mr. Taylor continues on the Board of the Corporation, but his reason for resigning was explained in that he has undertaken the management, as well as the presidency of the Algoma Steel Corporation and subsidiary companies.

Lumber Cut Decreased.—Reviewing the lumber trade of the Ottawa Valley, John Aird, assistant general manager of the Canadian Bank of Commerce, says the cut is estimated at 375,000,000 feet, or 100,000,000 feet less than for 1913, owing principally to low water conditions. In other sections of the province the decrease is proportionately greater. Dealing with market conditions, he predicts a revival of trade in the spring in the cheaper grades, but foresees even lower prices than in 1914 for higher grade lumber.

Australia Raises Duty.—The new Australian tariff increases the duty on Canadian farm implements in various degrees; some from free to 5 or 10 per cent.; some from 15 to 25 per cent., and some from 25 to 30 per cent., together with an increase in the specific duties. On pianos and organs the fixed duties are raised one pound sterling and the ad valorem from 35 to 40 per cent. The duty on the chassis of motor cars from Canada is increased from 5 to 10 per cent. There is also a 5 per cent. increase on many vehicle parts.

Personal

H. T. Glaubitz, manager of the waterworks department at London, Ont., has resigned.

George Sleeman has been appointed chairman of the Guelph Light and Heat Commission.

C. R. Hosmer has been elected president of Canadian Cottons, Montreal, succeeding the late David Morrice.

B. J. McCormick, Industrial Commissioner for eight years at Welland, Ont., has resigned to accept a captaincy in the 44th Regiment.

George H. Mullen has been made president of the E. B. Eddy Co., Hull, Que., in succession to the late W. H. Rowley.

Senator Nathaniel Curry, president of the Canadian Car & Foundry Co., Montreal, has returned home after a business trip to the Old Country.

Alexander Currie, engineer at the Dominion Government fish hatchery on waterworks point, died suddenly on Jan. 20 at Collingwood, Ont., aged 76.

A. W. Wheatley, general manager of the Canadian Locomotive Co., Kingston, has gone to Russia to obtain orders for war material from the Government.

J. M Jenckes, manager of the Jenckes Machine Co., Sherbrooke, P.Q., was re-elected by acclamation as an alderman of the Sherbrooke City Council, at the municipal election, January 11, 1915.

London, Ont.—It is understood that Engineer Somerset, who is in charge of the Hydro-Radial Department of the Provincial Hydro-Electric Commission, is to be appointed manager of the London and Port Stanley Railroad.

Hon. George A. Clare, M.P., president of Clare Bros. & Co., stove manufacturers, died at Preston, Ont., on January 9. Mr. Clare was born at Preston in 1854, and had been a member of the Dominion Parliament for South Waterloo since 1900.

R. Schofield, of the Schofield-Holden Machine Co., has disposed of his interest in the latter concern and has gone south for the winter to recuperate. Wallace C. Brown, who has been associated with Mr. Schofield for the past 14 years, is now general manager of the company.

Horatio F. Forrest, aged 76, a native of Montreal, and prominent civil engineer, died in Winnipeg on January 19. He was one of the engineers who located the C. P. R. track between Winnipeg and Kenora, and was afterwards Government inspector of railways and district engineer for the C. N. R.

Vincent S. Jones, for the past five years vice-president of the Harmsworth Company and general manager of the pulp and paper mills at Grand Falls, Nfld., has volunteered for service in Kitchener's army and is now with his old regiment, the "Borderers," as captain. William Scott, C.E., a director in the company, succeeds Mr. Jones as manager at Grand Falls Mills.

William H. Rowley, J.P., president of the E. B. Eddy Co., Ottawa, Ont., and a familiar figure in the business world of Canada, died very suddenly at Toronto on January 12. Mr. Rowley was born at Yarmouth, N.S., on March 21, 1851, and

from 1867 to 1886 was employed in banks in various capacities. In 1886 he organized the E. B. Eddy Co., becoming secretary-treasurer until 1906, when he was elected president.

Col. Davenant Roger, a prominent Canadian civil engineer, died on January 20, at Brooklyn, N.Y., in his 63rd year. He had been sent there by the Canadian Government to observe the construction of the Croton Aqueduct and the syphon under the Hudson River. Colonel Roger was at one time chief engineer for the Chilean Government. He also played a prominent part in the building of the C. P. R. and the Cape Cod Canal, and was about to start for Arizona to plan the construction of a large engineering undertaking.

J. F. Armstrong, C.E., of St. John, N.B., will be recommended by Commissioner Wigmore for the position of engineer of the water and sewerage department of St. John. Mr. Armstrong completed his course in civil engineering at the University of New Brunswick in 1910, and later followed a post-graduate course in hydraulics at McGill University, Montreal. He was engaged for several years in laying out and installing water and sewerage systems in towns in Northern Alberta. He also practised general engineering with the C. P. R. Mr. Armstrong is a son of R. E. Armstrong, secretary of the board of trade.

Refrigeration

Edmonton, Alta.—The United Farmers of Alberta at a convention just closed, prepared a resolution requesting the Provincial Government to co-operate in establishing a pork-packing plant.

Calgary, Alta.—J. C. Boyle, who has been prominent in packing circles in Alberta for the past twelve years, is negotiating with prominent financial interests for the bringing to this city of $1,000,000 for the construction and operation of a modern packing plant, capable of handling the surplus live-stock production of the district. Negotiations have been completed with Col. James Walker for a site for the plant.

Wood-Working

Stratford, Ont.—The McLagan Furniture Co.'s latest order from the Dominion Government includes packing cases for the shells to be manufactured elsewhere in the city.

Harriston, Ont.—The shareholders of the Harriston Furniture Co. held a meeting on January 9, when it was decided to resume operations at the factory after a close down of about ten days. The appointment is announced of a new manager to fill the vacancy caused by the death of Mr. Leighton.

Stratford, Int.—R. D. Kilgour, vice-president of the Imperial Rattan Co., has purchased what hitherto has been a part of the output of that concern, the "Simplicitus" davenport. He is moving the concern to Toronto. The Imperial Rattan Co. is enlarging its own chair plant. Mr. Kilgour's connection with that company continues.

Railways-Bridges

Port Dover, Ont.—The Lake Erie and Northern Railway Co. will proceed with the construction of the road from here to Brantford. The work involves the construction of two bridges at Brantford and Simcoe respectively.

Quebec, Que.—Incorporators of the town of Mount Royal, known as "Model City," at entrance to Canadian Northern tunnel, are asking for an extension of three years before members of the town council will have to qualify as residents.

St. Thomas, Ont.—A meeting was held in the city last Friday between representatives of Malahide, Aylmer, Yarmouth and St. Thomas, and George B. Woods and General Manager Warburton, of the London and Lake Erie Railway and Transportation Co., regarding the extension of the company's line from St. Thomas to Aylmer and from Union to Sparta.

Hudson Bay Railway.—Good progress on the Hudson Bay Railway has been reported to the Minister of Railways, by J. D. McArthur, of Winnipeg, contractor for the line. He stated that three hundred miles have been graded, while rails are down for two hundred miles. The grading to Port Nelson will be finished next summer, but the road will not be completed for a year and a half yet.

Vancouver, B.C.—An official announcement of the C. N. R. states that the tracks between the Yellow-head and coast sections would be connected up Saturday of last week, and the line will then be complete from Edmonton to Port Mann, fifteen miles from Vancouver. The next two months will be spent ballasting the line and making it ready for traffic. The ceremony of driving the final spike will probably not occur until April or May.

Perth, Ont.—Work on the Perth to Smith's Falls section of the Ottawa & St. Lawrence Electric Railway will begin in the spring, according to the promoters. The road will be 300 miles in length through Eastern Ontario, starting from Ottawa to Morrisburg, along the St. Lawrence through Brockville to Rockport, across by Charleston Lake to Athens, Frankville, Toledo, Smith's Falls, Perth, Lanark and back to Ottawa. Thirty miles in the eastern section is already constructed.

St. Mary's, Ont.—At the regular meetings of the new Water, Light and Heat Boards, steps were taken to arrange for a meeting at Kirkton to discuss power and radial railway projects. Delegates from Exeter and intervening points will be invited to be present. The board hopes to get comething definite under way before long towards the building of a new line, which will go through St. Mary's, and open up to the Stone Town a new and important trade district.

Kincardine, Ont.—The West Shore Railway, the ill-fated enterprise promoted by J. W. Moyes, may become a hydro-electric radial. In response to resolutions of some of the municipalities interested in the line, the Ontario Hydro-Electric Commission has prepared a report showing what can be done with the road. This document gives estimates of the cost of completing the line ready for operation, the annual revenue that may be expected and the annual operating expenses.

Hamilton, Ont.—While the engineers who met in Ottawa last week to go over the figures in connection with the separation of grades on Hunter Street did not come to any agreement as to figures, they discussed some important matters, and it was practically decided by them that to give the railway companies who use the Hunter Street line enough room, a large station would have to be built over the tracks similar to the new depot in New York City. This will cost more than the station between the proposed depression and Hunter Street that was first planned, but the saving in land damages will be great.

Contracts Awarded

Calgary, Alta.—The Calgary Saddlery Co. and Riley & McCormick Co. have been awarded part of the large contract let in Canada by the agents of the Russian Government for saddles.

Fort William, Ont.—A contract for a 750,000-bushel addition to the Ogilvie Milling Co. elevator has been given to the Barnett-McQueen Co. The figure for the work is about $200,000.

Kenora, Ont.—A contract for digging the channel from Indian Bay to Snow-

PROFESSIONAL DIRECTORY

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shoe Bay, on Shoal Lake, has been awarded by the Administration Board of the Greater Winnipeg water district to C. J. Anderson of Kenora, he being the lowest tenderer. Mr. Anderson's tender for the work was $12,765.

Building Notes

Toronto, Ont.—A building permit has been issued to S. Yolles for the erection of a four-storey brick warehouse and factory, costing $25,000, at 579-85 Richmond Street West.

Toronto, Ont.—The Ontario Hydro's new office building, in course of erection on University avenue, may be occupied in August. Excavation for the foundation goes down sixty feet to reach bedrock.

Vancouver, B.C.—Sir Richard McBride has announced that the erection of permanent buildings of British Columbia's new university will have to be postponed until a more favorable time comes for raising money. The staff has been engaged and plans are all ready.

St. John, N.B.—The University of New Brunswick, is raising funds for the purpose of erecting a new Science Building. About $17,000 has been contributed to date. J. T. Jennings is president.

Marine

New Liskeard, Ont.—The work of extending the present breakwater has been commenced. Fifty feet will be added to the structure.

New Westminster, B.C.—The steel tug "Queen," built by the Westminster Marine Railway for Greer & Coyle, of Vancouver, B.C., was launched from the builders' shipyard on Lulu Island on Jan. 19, and towed to the wharf of the Vulcan Ironworks for the installation of oil tanks. The Queen is an oil burner, and will be used by the owners in the log-towing business mainly. She is 87 feet long, 20 feet beam and has a maximum draught of ten feet. A big party, including many visitors from Vancouver, witnessed the launching of the vessel, which was the occasion of considerable enthusiasm among those concerned. It is about six months since the new vessel was laid down.

COMMERCIAL MUSEUM.

THE Hon. Robert Rogers, Dominion Minister of Public Works, has outlined a plan by which it is hoped to further the desire of Canadian manufacturers to put themselves in a position to replace goods of German and Austrian manufacture with those made in Canadian factories.

"There is now under consideration," says Mr. Rogers, "the establishing of a commercial museum for the purpose of displaying processes and products characterizing the great import trade from Europe to Canada. Object lessons should be given and practical teachers engaged to give details regarding materials and methods. Manufacturers and consumers will then be able to find out, before patronizing foreign countries, whether they can get in Canada what they require."

DOMINION TRADE WITH BRITAIN.

THE following are the official figures of trade between Canada and Great Britain in the undermentioned articles during December, 1914:—

Imports from		
Canada—	Dec. 1914.	Dec. 1913.
Wheat	£1,440,358	£911,469
Wheat meal & flour	155,516	196,171
Oats	13,235	34,525
Barley	16,296	27,790
Bacon	162,698	52,031
Hams	21,464	23,083
Cheese	372,236	236,875
Canned salmon	91,393	149,731
Canned lobsters	7,294	5,635
Exports to Canada—		
Spirits	24,091	52,970
Wool	10,939	14,348
Pig iron	520	2,085
Wrought rails	....	1,403
Galvanized sheets	8,137	8,564
Tinned plates	5,468	6,244
Steel bars	4,638	11,698
Pig lead	1,145	4,580
Cutlery	4,490	5,247
Hardware	2,966	6,039

ST. JOHN, N.B.

IT is extremely doubtful whether any other city in Canada has stood up so well under the disturbing conditions of commerce during the past two years as has the city of St. John, the commercial capital of New Brunswick, and the premier winter port of Canada.

The fact that St. John is the nearest Atlantic port to Montreal and the great Canadian West, gives it a very decided advantage in the commercial race. It cost the people of St. John about a million and a quarter dollars to demonstrate to the transportation companies and the Government of Canada than in St. John they have a national port that was worth developing. Since that demonstration was successfully made, providing the necessary harbor facilities has furnished employment summer and winter for a large number of people. This development work has been going on uninterruptedly for several years, and with the demands that ocean commerce are making, must go one for many years to come.

Recent Opening of New Dock.

A few weeks ago, another milestone on the commercial career of St. John was reached, when the big dock for the C.P.R., which a small army of laborers have been working on night and day for over eight months, was completed and formally handed over to the Federal Government. In the construction of this dock, between 500 and 700 men were employed; fifteen million feet of lumber went into crib work; 150,000 cubic yards of mined rock were utilized for ballast; 200 carloads of cement were consumed in concrete work. The Federal Government built a temporary shed, 800 feet long by 50 feet wide, on the pier, and the C. P. R. have laid down two lines of track alongside it.

Harbor Development

The harbor development at East St. John, which is under contract to the Norton, Griffiths Co., is going steadily forward. Several hundred men are employed in this undertaking, and the Hon. Robert Rogers, Minister of Public Works, stated at a public meeting during the month that the dry dock, which forms part of this East St. John scheme, will be enlarged to 1150 feet in length, making it the same size as the docks at Esquimalt and Halifax. A large business has been done in St. John during the closing months of the year in the shipping of remounts for the British army.

The construction of a new post office, the building of a large brick immigration building on Partridge Island, the erection of a tuberculosis hospital, besides a number of private erections, have kept carpenters and other builders fairly busy, so that there has been little complaint so far from unemployed.

The new steel bridge, which spans the reversing falls at St. John, is well advanced. The main bridge has been thrown across the river, and workmen are now employed in filling in the details. It will be completed next spring, and will be used by the Street Railway Company, as well as for general traffic. The completion of this bridge will open up some splendid residential and industrial possibilities in Fairville and West St. John.

The Street Railway Company has this year extended its lines towards the new dry dock site at East St. John, and also in the direction of Coldbrook, near which point the Glen Falls Development Co. are pushing a residential and industrial scheme. A. H. Likely has asked the city council to guarantee the bonds of a building company which proposes to erect several hundred workmen's houses at East St. John, near the harbor works.

Classified Advertisements

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?

Rates (payable in advance) :—2c per word first insertion, 1c per word subsequent insertion. 5c additional each insertion when Box Number is required. Each figure counts as one word.

¶ "CANADIAN MACHINERY" is the central market place of the machinery trades throughout Canada.

¶ There is always some one looking for just such a proposition as you have to offer.

FOR IMMEDIATE SALE AT HALF COST—furniture factory equipment, either separately or complete. Large surface plainer, turbon wheel, shaftin, lathe and pulleys, good as new, and water power site. John Waddell, Orono, Ont.

SNAPS IN MACHINE TOOLS—ONE 24 INCH x 24 inch x 9 feet Iron Planer. One 30 inch x 30 inch x 8 feet Iron Planer. One 30 inch x 30 inch x 10 feet Iron Planer. The foregoing all of Bertram & Sons' make. One No. 2 Rockford Universal Milling Machine, including vertical attachment and extra cutters. This machine has only been used a few days and is guaranteed in perfect order. Canada Machinery Agency, 298 St. James Street, Montreal. (6)

POSITION WANTED.

A PRACTICAL AND PROGRESSIVE BRASS Foundry Foreman would like to hear from an up-to-date firm requiring the service of a reliable executive. Good metal mixer and can produce first-class castings at a minimum cost. Best references. Address Practical, Canadian Machinery. (5)

FOR SALE OR TO LET.

AT EASY TERMS—THE SPLENDID FIVE storey building situated south-east corner of St. Antoine and Seigneurs Streets, occupied now by the Northern Electric Co., 32,000 feet of floor space, light on two main sides and one end; mill construction, sprinkler system, absolutely fireproof, fire escapes, electric light and elevator, steam heated. Large yard next to building if desired. Apply Jos. Bonhomme, 200 Guy Street, Montreal. (4)

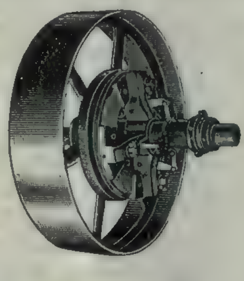
Armstrong & Bruce, representing another building syndicate, are also arranging for residential development at a point near the street railway line at the Douglas Road junction. The Fenton Land and Building Company have constructed a number of handsome residences at West St. John and in the city proper. Other building companies have also been active. Real estate has been very quiet the past year, but values have not depreciated. The winter port business is now well opened up, and the outlook for a profitable season's work is excellent, considering war conditions.

Value as a Distributing Centre.

The fact that St. John is the gateway for the St. John river gives it a great advantage and adds greatly to its value as a distributing point. This summer a large traffic was carried over the St. John river to St. John, principally of lumber. Much of this came from Maine points. The first quarter of 1913 showed the value of lumber exports through the port of St. John to the United States to be $297,539.34; second quarter, $451,942.61; third quarter, $407,647.40; fourth quarter, $370,140.24. Shipments of lumber from St. John to the United Kingdom, the European Continent, Australia and South Africa, during 1913, were as follows: Spruce deals, 80,714.861 sup. feet; hardwood plank, 5,823,761 sup. feet; birch timber, 2,307 tons.

Bank clearings at St. John in 1913 amounted to $82,447,747. This year the figures make a particularly favorable showing so far, the totals up to December 10 being $78,836,709. The clearing house figures for the week ended December 3, 1914, show that St. John and Ottawa were the only two cities in Canada in which there had been increases over the previous year. St. John's increase for the week amounted to $321,715, while that of Ottawa was $263,276. Building permits at St. John in 1913 amounted to $2,380,660; in 1912 they were $561,700. Figures are incomplete for 1914, but the showing, considering everything, is a good one. The value by months in 1914 is as follows: January, $10,000; February, $3,700; March, $78,500; April, $72,300; May, $79,700; June, $50,050; July, $110,400; August, $29,800; September, $10,450; October, $32,550; November, $20,950.

If what you want is not advertised in this issue consult the Buyers' Directory at the back.



The exports during 1913 were valued at $25,594,721, as against $21,895,963 in 1912; imports 1913, $9,873,026; 1912, $8,590.197. During 1913, 2,269 vessels entered the port. Grain exports during the winter season of 1913-14 amounted to 7,619,346 bushels, representing a value of $7,119,300. This was a slight falling-off over the two previous years. The customs receipts in 1913-14 amounted to $1,678,235.39, as against $1,760,639.45 in 1912-13.

A very interesting record of the city's progress is shown by its post office transactions during the past nine years. In 1904, the postal revenue at St. John amounted to $80,941.87, while in 1913 it had swollen to $141,068.11, the growth being steady during all that period with the exception of 1907, when there was a falling-off of about $8,000. The growth of population, while not rapid, has been of a healthy character. At the present time it is between 55,000 and 60,000 people.

War Effects.

It would be useless to deny that St. John has not suffered by the war. It has caused dislocation in many lines, but on the whole business is in a fairly healthy state, and the people are feeling optimistic. The shipping industry has received a great stimulus from the war, and freights have advanced to a point unheard of for many years. The lumber mills have been kept quite busy but some of them are slackening up a little now.

St. John has a very active Board of Trade, and one of its chief endeavors since the war started has been to stimulate business confidence. In this it has been wonderfully successful. Quite recently, it sent out circular enquiries to all the Maritime Boards of Trade, and the returns showed that throughout the whole territory, with only an occasional exception, business was being well sustained.

The farm crops this year in New Brunswick have been particularly good. Potatoes have been a large crop, there being a surplus of about 8,000,000 bushels for export. Hay showed a surplus of about 25,000 tons; cheese, 800,000 pounds. There were small surpluses for export in mutton, swine, poultry, oats and apples. In wheat, the province raised this year 25 p.c. of the amount needed for home consumption. The indications are that during the coming saeson a very much larger acreage will be planted. On the whole, both city and province have made fairly good progress during the first year.

Catalogues

McLain's System.—A bulletin, containing a synopsis of twelve lessons, giving particulars covering grey iron mixtures, cupola practice and the making of semi-steel, has been recently issued by McLain's System, Milwaukee, Wis. Each lesson deals with a different phase of foundry practice.

Friction Hoist.—The Herbert Morris Crane and Hoist Co., Toronto, are distributing bulletin B-11, dealing with the Morris belt-driven friction hoist. General particulars and prices are given of hoists with working loads up to one ton. Two illustrations of hoists in operation are given, while diagrams are included of suspended and floor type hoists, showing principal dimensions for each size.

Lighting Systems.—A comprehensive general catalogue, No. 71, has been issued by the National Stamping and Electric Works, Chicago, Ill. The principal systems described are the "Acme" air light gas system and the "Nulite" hollow wire lighting system. A full description is given of each, with instructions for installing and operating, accompanied by diagrams. Particulars are given of the various fittings and also of the gasoline portable and stationary lamps. The catalogue is fully illustrated and shows many different styles of lamps and chandeliers.

Pelton Wheels.—Bulletin No. 8, issued by the Pelton Water Wheel Co., New York and San Francisco, Cal., describes Pelton wheels particularly adapted to driving mining, saw mill and industrial machinery generally. The catalogue has been published with a view of acquainting the prospective purchaser with a few types of standard designs. For fuller particulars of the subject the reader is referred to other publications to be had from the company. This bulletin, however, contains much useful information both as regards the construction of the Pelton wheel and other hydraulics. Pipe friction and weir measurement tables are included, also tables giving the size of wheel and horse-power for various heads. The bulletin is fully illustrated and shows several views of installations, pipe lines and pipe details, etc.

CO_2 Recorder.—Those interested in boiler room efficiency will find in bulletin No. 100, entitled "Combustion and Cost of Power," issued by the Uehling Instrument Co., Passaic, N.J., much valuable information regarding the measurement of waste heat in flue gases. The bulletin describes how waste heat may be measured and how a considerable saving in coal may be effected by a proper understanding of the subject. The Uehling CO_2 Recorder is described, and method of measuring dealt with

fully. The Uehling waste meter is also illustrated and described. The bulletin contains 36 pages of interesting matter, and also a number of illustrations and diagrams.

Centrifugal Pumps.—What is probably the most complete commercial publication devoted solely to centrifugal pumps is being distributed by the De Laval Steam Turbine Co., of Trenton, N.J. This book of 298 pages contains over 300 illustrations, including centrifugal pumps for all capacities and heads, and for motor and steam turbine drives. Diagrams show the characteristics of such pumps and explain the relations between impeller blade angles and characteristics. There are also numerous illustrations of the DeLaval reducing gear employed to allow electric motors, water turbines, steam engines and steam turbines to operate at the most economical speed when driving a centrifugal pump. The text matter is divided into chapters under such headings as "The Introduction of the Centrifugal Pump and the Work for Which It Is Adapted"; "Features to be Considered in Selecting Centrifugal Pumping Equipment"; "The Use of the Characteristic Curve"; "Methods of Testing Centrifugal Pumps"; "System of Manufacture for the Production of Interchangeable Parts"; "Details of Design and Construction of Single-stage and Multi-stage Pumps"; "The Speed Question, Particularly Relating to Steam Turbine-Driven Centrifugal Pumps"; "Helical Speed-reducing Gears"; "Motor and Belt Drives"; "High Duty Steam Turbine-Driven Pumps as Compared with Reciprocating Pumping Engines for Water-works Service"; "The Adaptation of Pumps for Circulating Condenser Water, Feeding Boilers and Other Steam Power Plant Service"; "Drainage and Irrigating Pumps"; "Hydraulic Pressure and Elevator Pumps"; "Pumps for Marine Uses, Mining Service, Fire Service and Hot Water and Brine Circulation," etc. Tables and charts are given for determining the resistance of pipes and the relation between heads and spouting velocities. The investigation of the pumping problem, together with drawing up of specifications for centrifugal pumps, are also treated at some length. The chapters on "Pump Characteristics" will prove valuable to the pump user, while that on "Waterworks Pumps" will be a revelation to many who have not recently given this matter consideration.

The Production of Iron and Steel in Canada During 1913

By John McLeish, B.A.*

Iron and steel enter so largely into the industrial life of our country as constituents of manufacturing equipment and as the products of the latter that interest never flags in but rather looks forward with anticipation to statistics of every particular bearing thereon. This data from a recent Government report will therefore be found educative and valuable.

STATISTICS of iron ore, pig-iron and steel production gathered from the Department of Mines (Ottawa) report just issued for 1913, show increased shipments of iron ore from Canadian mines, an increased production of pig-iron and steel in Canadian furnaces and steel plants, and an increase in the imports of most classes of iron and steel products; but the general relationship of domestic iron ore supplies to furnace requirements exhibits no important change from the conditions that have obtained for a number of years past. Canadian furnaces continue to be operated almost entirely on imported ores, and Canadian iron and steel plants supply probably less than 30 per cent. of the present consumption.

Comment has previously been made on the comparatively small proportion of Canada's consumption of iron and steel now supplied from the country's domestic resources, and this fact is again emphasized in the statistics of production, imports, and exports for 1913. It is somewhat difficult to arrive at a complete estimate of the total consumption of iron in Canada because of the large value of iron and steel goods imported for which the quantity cannot be stated, nevertheless the percentage of consumption available from Canadian mines can be closely gauged. The imports and exports of iron and steel goods (not including iron ore) may be sub-divided into two classes, comprising the materials of which the quantity is stated and materials or goods of which the value only is recorded.

Value of Net Total Imports.

It is probably safe to estimate that the value of $72,181,060 of net imports represents not less than 100,000 tons of iron or steel and probably not more than 720,000 tons. Assuming these limits and assuming further that the iron or steel represents 50 per cent. of the original ore charged, we have net imports of iron and steel goods (exclusive of iron ore) equivalent to a tonnage of iron ore between the limits of 3,761,186 tons and 5,004,806 tons. Adding the consumption of iron ore in Canadian iron and steel furnaces, we have a total equivalent consumption of iron ore not less than 6,066,464 tons and probably not exceeding 7,310,088 tons. The production of iron ore in Canada in 1913, viz., 307,634 tons, was, therefore, sufficient to supply probably over 4.2 per cent., but not more than 5 per cent. of the country's requirement of iron.

Iron Ore.

The total shipments of iron ore from Canadian mines in 1913 were 307,634 tons, valued at $629,843 at the shipping point, as compared with shipments in 1912 of 215,883 tons, valued at $523,315. Of the total shipments in 1913, 91,020 tons were sent to blast furnaces in Canada 196,151 tons to the United States, 12,927 to Scotland, and 7,536 tons to Holland. The shipments comprised 92,386 tons of hematite and roasted siderite, 209,886 tons of magnetite (including some ores with an admixture of hematite), and 5,362 tons of titaniferous iron ore. Shipments in 1912 included 86,971 tons of hematite, 127,727 tons of magnetite, and 1,185 tons of titaniferous ore. Nova Scotia, New Brunswick, Quebec and Ontario were the shipping provinces. No production has been reported from British Columbia for the past seven years.

Exports and Imports of Iron Ore.

According to returns received direct from mine operators, 196,151 tons were shipped to the United States, 12,927 tons to Scotland, and 7,536 tons to Holland, or a total of 216,614 tons shipped to destinations outside of Canada during 1913. The exports from Canada during this period, according to the records published by the Department of Customs, were 126,124 tons valued at $426,681, and included 107,624 tons valued at $355,641 to the United States, 11,800 tons valued at $45,312 to Great Britain, and 6,700 tons valued at $25,728 to other countries.

The exports in 1912 were 118,129 tons valued at $382,005, including 95,579 tons valued at $295,213 to the United States, 16,800 tons valued at $64,712 to Great Britain, and 5,750 tons valued at $22,080 to other countries. The exports in 1911 were 37,686 tons valued at $133,411, all to the United States. That the Customs Department record of exports to the United States would appear to be understated in 1913 is confirmed by the record of imports of iron ore into that country from Canada, as shown in the "Monthly Summary of Commerce and Finance of the United States." According to this authority the imports of iron ore into the United States from Canada during the calendar year 1913 were 201,489 short tons valued at $413,314, as compared with 119,476 tons valued at $201,882 in 1912, and 56,538 tons valued at $106,038 in 1911.

The imports of iron ore into Canada were not separately shown by the Customs Department until April, 1912. The imports during the twelve months ending December, 1913, were reported as 1,942,325 tons valued at $3,877,824, and during the nine months ending December, 1912, 2,047,509 tons valued at $3,932,074. The imports in 1913 included: 1,072,156 tons valued at $3,007,653 from the United States, 869,669 tons valued at $869,669 from Newfoundland, and 500 tons valued at $502 from other countries.

There were used in Canadian furnaces in 1913, 2,110,828 tons of imported iron ores, as compared with 2,019,165 tons in 1912, the imported ores being obtained chiefly from Newfoundland and the iron ranges on the south shore of Lake Superior. The Newfoundland deposits are operated by the two Canadian companies operating coal mines and steel plants at Sydney and Sydney Mines in Cape Breton, and the total quantity of Newfoundland ores shipped during 1913 from the Wabana mines was 1,605,920 short tons, of which 1,048,432 tons were shipped to Sydney and 557,488 tons to the United States and Europe. In 1912 the shipments from Wabana, Newfoundland, were 1,331,912 short tons, of which 956,459 tons were shipped to Sydney and 375,453 tons to the United States and Europe.

According to the "United States Report of Commerce and Navigation," there were exported to Canada during the twelve months ending June, 1913, 1,367,928 tons (2,000 pounds) of iron ore valued at $3,684,233, and during the previous year 931,647 tons (2,000 pounds) valued at $2,806,238.

Pig-Iron and Steel.

The making of iron and steel in Canada is an industry which has been built up largely on the basis of imported ores, and the output continues to increase. The total production of pig-iron in 1913, not including the output of ferro products which is separately tabulated, was 1,128,967 short tons (1,008,006 long tons) valued at approximately $16,540,012, as compared with 1,014,587 short tons (905,881 long tons), valued at $14,-

*Chief of the Division of Mineral Resources and Statistics.

550,999 in 1912, and 917,535 short tons (819,228 long tons), valued at $12,307,-125 in 1911. An increase of 11.3 per cent. is shown in the production of pig-iron in 1913 over the production of 1912, as compared with an increase of 10.5 per cent. in 1912 over that of 1911.

Pig-Iron Furnaces.

At the close of the year Canada had twenty-two completed furnaces grouped in twelve separate completed plants owned by nine companies or corporations. Of the twenty-two completed furnaces, five have been idle throughout the past two years, namely, the furnace at Londonderry, N.S., and the three small furnaces in the Province of Quebec, owned or controlled by the Canada Iron Corporation, and the furnace of the Atikokan Iron Company at Port Arthur. The aggregate daily capacity of these five furnaces was approximately 235 tons. During 1913, however, three new furnaces were brought into operation, with a total daily capacity of about 665 tons.

Of the total output of pig-iron in 1913, 23,696 tons valued at $423,140, or $17.86 per short ton, were made with charcoal as fuel, and 1,105,271 tons, valued at $16,116,872, or $14.58 per ton, with coke. The amount of charcoal pig-iron made in 1912 was 21,701 tons, and in 1911, 20,759 tons, while the quantity made with coke in 1912 was 992,886 tons, and in 1911, 896,776 tons.

The classification of the coke iron production in 1913, according to the purpose for which it was intended, was as follows: Bessemer 265,685 tons; basic 614,845 tons; foundry, including miscellaneous, 224,741 tons. The classification of the production in 1912 was: Bessemer, 256,191 tons; basic, 544,534 tons; foundry, including miscellaneous, 192,161 tons.

Provincial Pig-Iron Output.

The total production of pig-iron in 1912 and 1913 belongs to the Provinces of Nova Scotia and Ontario; the Province of Quebec have dropped out during these years, although formerly there had been a continuous though small output of charcoal iron which commanded a high price.

During 1912, Nova Scotia produced 424,994 tons of a value of $6,374,910, and in 1913 its output was 480,068 tons of a value of $7,201,020. During 1912, Ontario produced 585,593 tons of a value of $8,176,089, and in 1913 its output was 648,899 tons of a value of $9,338,992.

It should be explained that the value placed upon the pig-iron production of Nova Scotia is assumed or estimated, a large proportion of it being directly converted into steel, and the remainder only being sold as pig-iron.

Exports and Imports of Pig-Iron.

The total exports of pig-iron, including ferro-alloys, during 1913 were 6,326 tons valued at $351,646, or an average value per ton of $55.59, as compared with exports of 6,976 tons valued at $310,702, or an average of $44.54 in 1912. The exports during the past five years have not exceeded 10,000 tons in any one year, and have consisted largely, if not entirely, of ferro-alloys.

Considerable quantities of pig-iron are annually imported into Canada. During the calendar year 1913, the total imports of pig-iron, excluding ferro products which are separately stated, were 236,769 tons valued at $3,247,405, and included 213,969 tons valued at $2,888,-974, or an average of $13.50 per ton, from the United States, and 22,800 tons valued at $358,431, or an average of $15.72 per ton, from Great Britain. The total imports in 1912 were 272,565 tons valued at $3,511,599, or an average of $12.88 per ton; and in 1911, 208,487 tons valued at $2,610,989, or an average of $12.52 per ton. The 1913 imports included 926 tons of charcoal pig-iron valued at $12,528, or $13.52 per ton, as compared with imports of 115 tons of charcoal pig-iron in 1912 valued at $1,-370, or an average of $11.91 per ton.

Ferro-Products.

Ferro-silicon, ferro-phosphorus, and ferro-manganese were produced in Canada in electric smelting plants in 1913, the latter two products in small quantities only. Ferro-silicon and ferro-manganese were made at Welland, Ont., by the Electro Metals, Ltd., and ferro-phosphorus was made at Buckingham, Que., by the Electric Reduction Co. The Algoma Steel Corporation did not operate their electric furnace at Sault Ste. Marie during the year.

The total production in electric furnace plants during 1913 was 8,075 short tons of ferro-alloys valued at $493,018. In 1912 the production was 7,834 short tons valued at $465,225, and in 1911, 7,507 short tons valued at $376,404.

The imports of ferro-silicon, ferro-manganese, etc., during the calendar year 1913 were 30,355 tons valued at $940,-443, or an average of $30.98. The imports for the calendar year 1912 were 19,810 tons valued at $469,884, or an average of $23.72 per ton; and in 1911, 17,226 tons valued at $429,465, or an average of $24.93 per ton.

Consumption of Pig-Iron.

An estimate of the total consumption of pig-iron and ferro-alloys in Canada may be arrived at on the basis of the record of production, imports and exports. The total production of pig-iron in 1913 was 1,128,967 short tons, and of ferro-alloys 8,075 tons. The imports of these products during the same period were 267,124 tons, and the exports 6,326 tons. The deduced consumption of pig-iron and ferro-alloys was approximately 1,397,840 tons. Of this amount, 943,130 tons were used in steel furnaces in the production of steel, leaving 454,710 tons for foundry and other uses.

Steel.

The production of steel ingots and castings in 1913 was 1,168,993 tons, as compared with 957,681 tons in 1912, and 882,396 tons in 1911. In 1913 the production of open-hearth ingots was reported as 824,818 tons; Bessemer ingots, 301,932 tons; direct open-hearth castings, 39,217 tons; and other steels, 3,026 tons. The total increase in production over 1912 was 211,312 tons, or about 22.06 per cent.

The total quantity of pig-iron used in steel furnaces during the year 1913 was 913,722 tons, of which 860,360 tons were produced by firms reporting, and 53,362 tons purchased. The quantity of ferro-alloys used was 29,408 tons purchased. Scrap, etc., was used to the extent of 406,403 tons, being 277,509 tons produced by the firms reporting, and 128,-894 tons purchased. Ores used included 1,342 tons of manganese ore and 55,018 tons of iron ore, while 197,028 tons of limestone or dolomite flux were used, and 10,687 tons of fluorspar. In Ontario, a little over 413,000,000 cubic feet of natural gas were used, while in Nova Scotia coke-oven gas was used at Sydney, of which a record of quantity was not obtained.

In 1912, the total quantity of pig-iron used in steel furnaces was 735,559 tons, of which 706,895 tons were produced by firms reporting, and 28,664 tons purchased. The quantity of ferro-alloys used was 24,237 tons purchased. Scrap, etc., was used to the extent of 336,265 tons, being 223,404 tons produced by the firms reporting, and 112,861 tons purchased. Ores used included 985 tons of manganese ore, and 43,006 tons of iron ore, while 148,045 tons of limestone or dolomite flux were used, and 9,709 tons of fluorspar. In Ontario, a little over 423 million cubic feet of natural gas were used. The following is a list of firms making steel in Canada:—

Steel Producing Firms.

Dominion Iron and Steel Co., Sydney, N.S.

Nova Scotia Steel and Coal Co., New Glasgow, N.S.

Canadian Steel Foundries, Ltd., Montreal, Que.

Beauchemin et Fils, Sorel, Que.

The Algoma Steel Corporation, Sault Ste. Marie, Ont.

The Steel Company of Canada, Ltd., Hamilton, Ont.

The Dominion Steel Foundry Co., Hamilton, Ont.

The Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.

The Moffat Irving Steel Works, Ltd. (Electric), Toronto, Ont.

Rolled Products, etc.—Complete statistics of the production of rolled products and of manufactured steel have not been received; returns from several of the largest producers, however, show a production of blooms, billets, slabs, etc., of 1,134,277 tons, of which 1,098,877 tons were used by the producer for further manufacture, and 35,400 tons sold to other rolling mills.

The production of rails was 554,481 tons; of rods, 57,389 tons; of bars, 266,915 tons; and of other rolled products, 53,835 tons. The production of steel rails in 1912 was returned as 471,422 tons, and in 1911 399,760 tons.

Exports and Imports of Iron and Steel Goods.

The exports of iron and steel from Canada consist chiefly of manufactured goods, such as agricultural implements, automobiles, bicycles, machinery, etc. Compared with the value of imports, the total value of the exports is small, amounting to not more than 10 per cent. of the former. The total value of iron and steel exported during the calendar year 1913 was $13,999,149, as compared with a value of exports in 1912 of $10,682,484, and in 1911 of $9,907,281. The exports during 1913 included: pig-iron and ferro-products, etc., to the value of $351,646; crude iron and steel valued at $483,813; stoves, gas buoys, castings, machinery, hardware, etc., valued at $1,070,476; steel and manufactures of steel, $1,051,004; agricultural implements, $7,411,246; automobiles and bicycles, $3,630,964.

The exports during 1912 in similar grouping were: pig-iron and ferro-products, etc., $310,702; scrap iron and steel, $145,250; stoves, gas buoys, castings, machinery, hardware, etc., $1,290,762; steel and manufactures of steel, $785,731; agricultural implements, $5,967,545; automobiles and bicycles, $2,182,494.

The total value of the imports of iron and steel goods during the calendar year 1913 was $141,272,357, as compared with a value of $144,400,949 imported during the fiscal year ending March, 1913, and a value of $102,568,832 imported during the fiscal year ending March, 1912. The total value of the imports during the fiscal year 1911 was $85,319,541, and during the fiscal year 1910, $59,952,197.

The rapid growth in imports of iron and steel is thus clearly shown in this statistical record. It will be observed, however, that there has apparently been a check to these imports during the last nine months of 1913, there having been a falling off in the total imports during the twelve months ending December, 1913, as compared with the twelve months ending March of the same year.

The imports during the twelve months ending December, 1913, subject to duty were valued at $125,082,378, the imports duty free during the same period being valued at $16,189,979, making a total value of $141,272,357. The imports during the fiscal year ending March, 1913, subject to duty were valued at $129,131,275, and the imports duty free during the same period were valued at $15,269,674, making a total of $144,400,949. These imports include all classes of iron and steel goods manufactured as well as those of the cruder form.

> **ALL FOR NATION'S SAFETY.**
>
> **"It should be plain to everyone that in the stress of danger to the life of any nation at war, the courts should be exceedingly careful not to hamper the actions of those expressly charged with the safety of the nation; careful, among other things, not to take up the time and attention of those who should be fighting the enemy in the field, in fighting law suits in the law courts over private rights. It is not a time when the prisoner is to have the benefit of the doubt: it is a time when in all things, great and small, the country must have every possible advantage."—Chief Justice R. M. Meredith.**

There were imported during the twelve months ending December, 1913, 1,832,475 tons of iron and steel goods valued at $55,927,607, or an average value per ton of $30.52, together with other iron and steel goods of which the quantities are not stated, valued at $85,344,750. During the twelve months ending March, 1913, there were imported 1,875,172 tons of iron and steel goods valued at $53,239,212, or an average of $28.39 per ton, together with other manufactures of iron and steel of which the quantity is not stated, valued at $91,161,737.

The imports of pig-iron have varied considerably during the past six years and the imports in 1913 are not very much larger than those of 1908. The imports of ferro-products and chrome steel have increased during six years by over 90 per cent. The imports of ingots, blooms, billets and puddled bars have more than doubled in that period. The imports of scrap iron and scrap steel show an increase of about 40 per cent. in the six years. The imports of plates and sheets, and of bars, rods, hoops, bands, etc., were nearly three times as great in 1913 as in 1908. The imports of structural iron and steel have increased steadily since 1909, but were larger in 1908 than in any other year of this period, with the exception of 1913. The imports of steel rails, pipe and fittings, nails and spikes, iron forgings, castings, and manufactures have varied considerably, but reached a maximum in 1913.

A very large proportion of these imports is derived from the United States, records published in the "Commerce and Navigation of the United States" showing the exports of iron and steel goods from that country to Canada. According to this authority there were exported to Canada from the United States during the twelve months ending June 30, 1913, 1,695,916 tons of iron and steel goods valued at $51,936,616, together with other iron and steel goods of which the weight is not given, valued at $54,053,014, or a total value of imports from the United States of $105,989,630.

During the twelve months ending June 30, 1912, the corresponding exports to Canada were 1,175,464 tons valued at $36,637,305, together with other iron and steel goods valued at $46,020,989, or a total value during the year of $82,658,294.

NICKEL-PLATING ALUMINUM.

A communication has recently been presented to the Academie des Sciences by M. Le Chatelier, in which the author states that he has succeeded in nickel-plating aluminum, hitherto unaccomplished. This has considerably prevented the extension of employment of this metal, which lends itself to so many purposes, since its dull appearance, especially after prolonged use, has been much against it. The difficulty has been surmounted by a preliminary scouring of the aluminum in a bath of hydrochloric acid containing iron. The iron precipitated on the surface of the aluminium forms a kind of network, and when the piece of metal is then passed into the nickel bath, the nickel becomes fastened in this network and adheres strongly to the aluminium.

Industrial Peace Prevails—Industrial peace prevails in Canada at the present time, only one conciliation board having been constituted lately, to deal with a dispute between the city of Edmonton and its electrical employees. Judge Hyndman is chairman.

Relative to Cam Grinding and Cam Grinding Equipment--III.

By Howard W. Dunbar.

The purpose of this series of articles is to describe as clearly as possible the methods employed by the Norton Grinding Co., Worcester, Mass., in the production of the master cams which are used for cam grinding. There are doubtless many of our readers whose knowledge of the subject will be materially increased thereby. Text and cuts, courtesy Norton Co.

BRIEFLY, the production of master cams is accomplished by reversing the operation of grinding the cam shaft. In place of the large grinding wheel on the machine is a plain disc of exactly the same diameter as the wheel, and in place of the roll which the master cams operate against is a grinding wheel of the same diameter as the roll, suitable means being provided to drive the wheel at the proper speed.

In Fig. 1 is illustrated this operation, using the cam grinding attachment in which the cam shafts are to be ground. The disc is shown at (2) bearing against the model cam shaft (4) mounted on the centres of the attachment, and driven by dog (3). The wheel for grinding the masters is shown at (1), carried on a special spindle provided with a pulley and belt for driving the wheel. The hardened master cams (5) previously roughed to the approximate form are mounted on the master cam spindle ready for the grinding operation. The bearings of the master cam spindle and the centres of the attachment lie exactly in line. As the spindle, wheel and disc revolve, the shape of the model cam as it bears against the disc on the wheel spindle gives an oscillatory motion to the attachment, reproducing on the master cam blanks a shape which will produce cam shafts exactly like the models.

Master Cam Grinding Feed.

In order to provide for a feed in grinding the masters, the operation is exactly the reverse of that ordinarily used in grinding machines. In other words, instead of feeding the wheel slide towards the operator it is fed away from the operator. It will, therefore, be seen that in first starting to grind the masters, the disc must be brought in towards the operator far enough to force the attachment which carries the master cam blanks to swing away from the grinding wheel (which has a fixed position in relation to the centre line of the pivots of the attachment) far enough to allow the starting of the grinding operation and, as this proceeds, to gradually move the wheel slide back until the desired shape is produced. This position is governed by the smallest master on the spindle. When this has been ground and "cleaned up" around the entire periphery, a reading is taken on the index, and thus is determined the position to stop for all blanks. The same procedure is followed in grinding masters for loose cams, and as illustrated by Fig. 2, the elements being numbered the same as in Fig. 1.

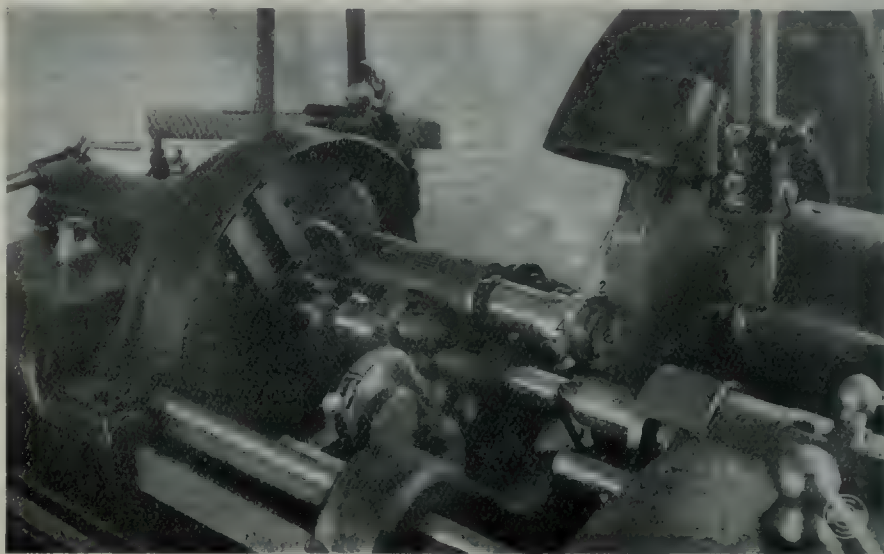


FIGURE 2.

Marking the Soft Blanks.

An interesting operation in the grinding of masters is the method used in marking the soft blanks preparatory to roughing down to the approximate contour. This is accomplished by mounting all the blanks on the roughing master cam spindle, and allowing the small grinding wheel to bear on the side of the blank, as illustrated in Fig. 3 on page 11. Otherwise the fixture is set us as though ready to grind master cams. As the machine is started, the model produces the required motion in the fixture as it bears against the disc on the wheel spindle, to describe a line on the side of the blank with the rapidly revolving grinding wheel, which approaches the correct contour of the cam outline.

To accomplish this it is necessary to start with the extreme high point on the tip of the model cam bearing against the disc, and allow it to make one complete revolution, coming back to this same point. This operation is repeated for each cam to be ground, after which they are removed from the spindle and formed to this rough outline and hardened. After hardening, and after grinding the keyways with a special fixture to fit the regular master cam spindle, the holes are ground. During this operation of mark-

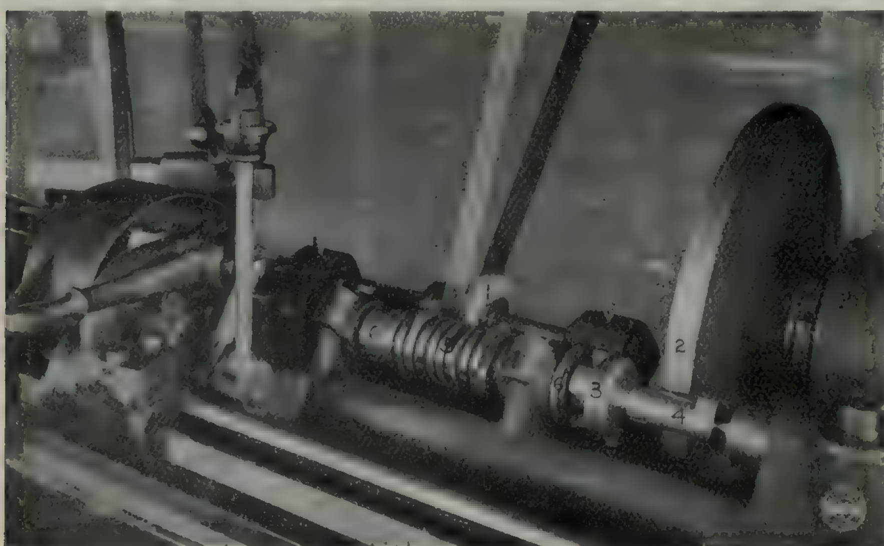


FIGURE 1.

ing the cams, the wheel slide must remain in the one position, determined by the first outline marked.

With a set of model cams completed, which, when carefully inspected and tested comply with all of the requirements, we are ready to take up the grinding of master cams and, to successfully accomplish this, requires slight changes in the setting up of the machine,

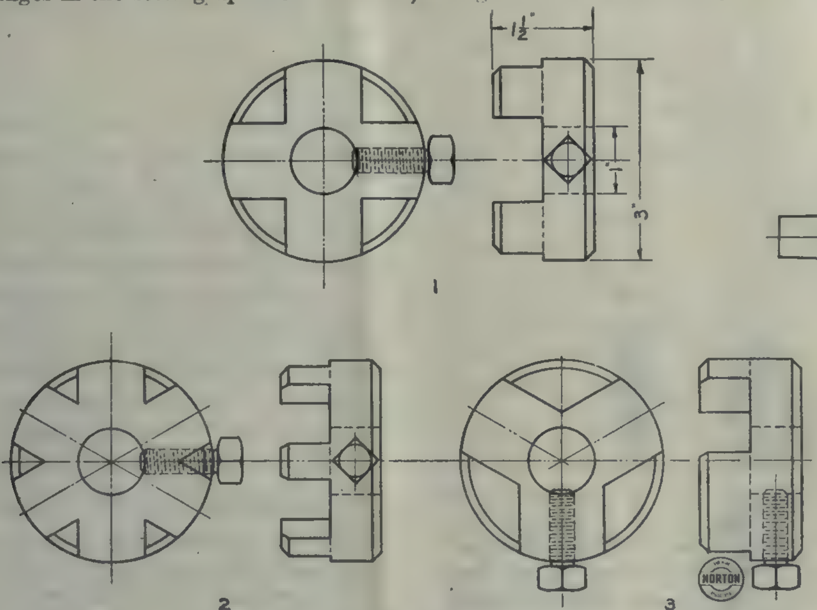


FIG. 4. MODEL CAM DRIVING DOGS.

as described later, and makes necessary the following equipment:

Grinding wheel bracket with 4 in. diameter grinding wheel, arbor and sleeve.
Model disc.
Model cam driving dog.
Set of master cam blanks.
Roughing master cam spindle.
Regular master cam spindle.
Inspection machine.

Grinding Wheel Bracket, etc.

These parts replace and occupy the same position as the roll bracket on the in-

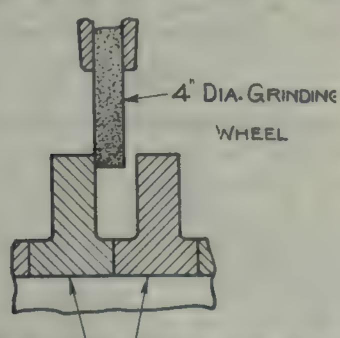


FIG. 3. MASTER CAM BLANKS, METHOD OF MARKING.

tegral cam grinding attachment, and are provided with means for driving, independent of the attachment drive. This may be accomplished by either jack shaft, or motor, and pulleys. It is generally placed towards the rear of the machine and in such a position that the direction of the belt will be in a line about 45° from the horizontal. It is important that the driving drum be at least 10 in. long to allow for the positioning of the small grinding wheel in front of the various master cam blanks to be ground, and also to allow for a sufficient amount of table travel to place the large disc in front of the model cams.

Model Disc.

This is known as the model disc because it is used in place of the grinding wheel, and bears against the models, giving the motion to the attachment which forms the correct shape on the masters. It is very important that this be of the exact diameter of the grinding wheel to be used in cam shaft grinding, which in all attachments (except the No. 1 individual) is 18 inches. It is used in position on the end of the wheel spindle of the machine, and is revolved by the friction between it and the model cam.

Model Cam Driving Dog.

Several styles of model cam driving dogs are used, and all have their special purpose. Too much importance cannot be placed on the relationship of the driving dog to the model cam shaft, as this

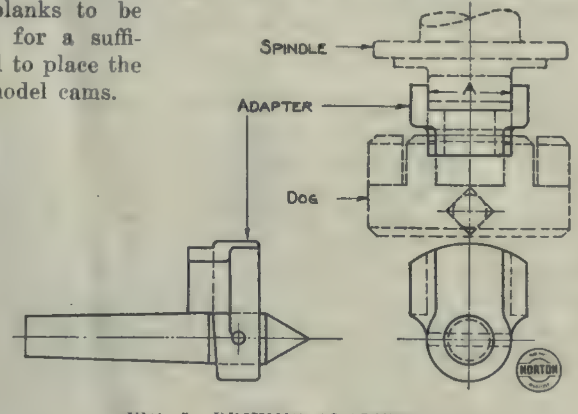
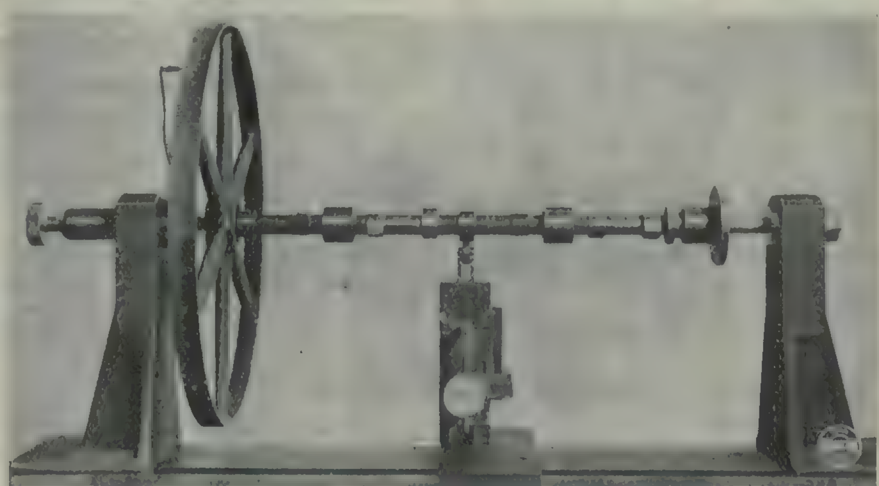


FIG. 5. DRIVING ADAPTER.

is a very important item, and on it largely depends the accuracy of positions the masters bear to each other. The model cam driving dog must bear exactly the same relation to the cams on the model cam shaft as the regular driving dog bears to the cam shafts in the cam grinding operation.

Fig. 4 shows the general types of dogs used for one, two, four and six-cylinder cam shafts. No. 1 is designed for a one, two or four-cylinder shaft. It will be noticed that the slots which engage the driving prong on the fixture are spaced 90° apart. Once the dog is attached to the shaft it should never be moved until the grinding operation is completed, indexing being taken care of by the slots above mentioned.

The dog marked No. 2 is used for a six-cylinder shaft, but because of the narrowness of the slots it is necessary to use an adapter for driving, which will fit into the slots and engage the driving projection on the attachment. This adapter is illustrated by Fig. 5, in which



CAM INSPECTION FIXTURE.

the master cam dog is dotted in position, and the adapter engages the driving projection on the master cam spindle at "A." The use of this adapter is overcome by dog marked No. 3, but it has an objection, as it is necessary to move this dog 180° on the model cam shaft in or-

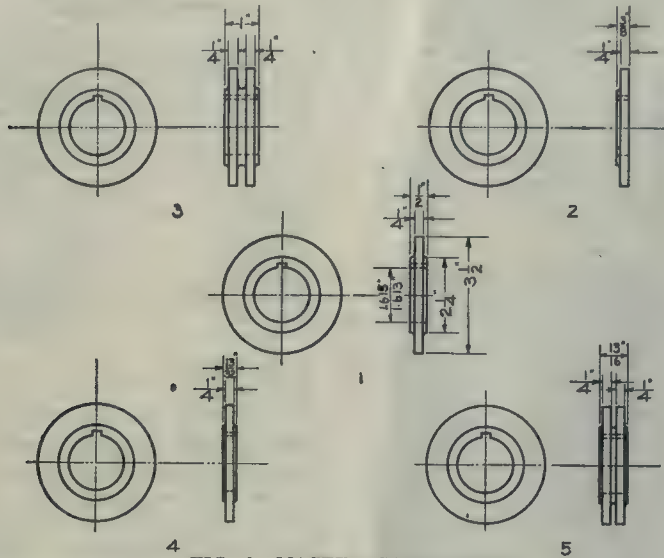


FIG. 6. MASTER CAM BLANKS.

der to grind all the masters required on a six-cylinder cam shaft. This, of course, makes it necessary to use an inspecting machine such as previously described, and mentioned briefly later.

Set of Master Cam Blanks.

Master cam blanks are made of an exceptionally good grade of steel and carefully hardened to give the best wearing surface possible, in order to insure that they keep their shape for a long time. The number of cam blanks is always determined by the number of cams on the cam shaft to be ground, one blank being provided for each cam, auxiliary or eccentric. The attachment is limited to fourteen in number, and on this, and various other conditions, depends the type of blank used, all of which are illustrated in Fig. 6.

No. 1 blank is used when there are from one to eleven master cams on the spindle, none of which are to be used for the production of auxiliary cams.

No. 2 blank is used for the twelfth cam when there are twelve cams on the

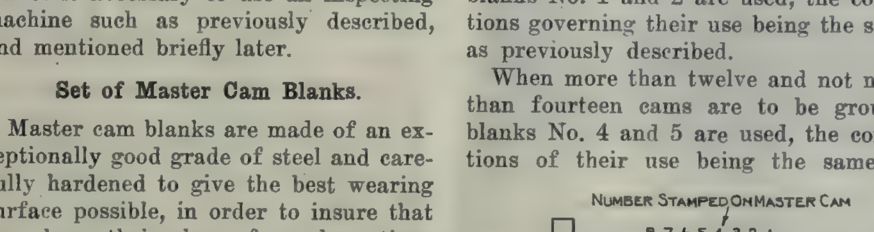


FIG. 7. MASTER CAM SPINDLE.

spindle, the first eleven being made like blank No. 1. This twelfth blank is always placed nearest the threaded end of the spindle.

When there is an auxiliary or relief cam to be ground, and not more than twelve masters are to be mounted, a double blank is used, as shown by No. 3. The auxiliary master cam is formed on one side, and the master cam, with which the auxiliary is associated, on the other.

For all other cams which do not have auxiliary cams associated with them, blanks No. 1 and 2 are used, the conditions governing their use being the same as previously described.

When more than twelve and not more than fourteen cams are to be ground, blanks No. 4 and 5 are used, the conditions of their use being the same as

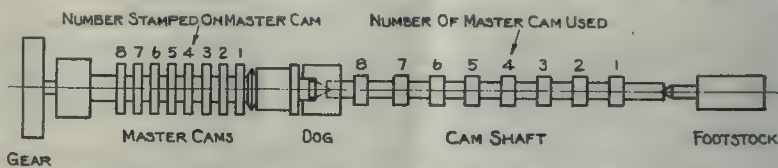


FIG. 8. ORDER OF NUMBERING CAMS.

treated under blanks No. 1 and 3. Where double master cam blanks are used they are always considered as two blanks when determining the number of master cams to be mounted.

Submarine Construction in Montreal.—We are advised by the Department of Militia and Defence at Ottawa, that they gave no authorization to the statement contained in a Montreal newspaper, and which was reproduced by us relative to submarine construction in progress at the plant of Canadian Vickers, Ltd.

DOMINION STEEL PRESIDENT ON OUTLOOK.

THAT there is a fair amount of business offering in Europe for the Canadian steel companies, but that they are considerably hampered in handling it owing to the difficulty of getting steamers to transport their freight across the Atlantic, is the statement made by J. H. Plummer, president of the Dominion Steel Corporation, who has just returned from an inspection trip to the company's plants at Sydney.

"As regards our European business, conditions are very fair," said Mr. Plummer. "The trouble is that there is not much margin of profit in it, and that, because the British and French Governments have commandeered so many vessels, it is difficult to get shipping space. The result is that, although prices on steel and iron products in Europe have recovered from their recent depression, the increased cost of transportation to market offsets the higher quotations."

Mr. Plummer reports that the steel business in this country has not shown any improvement as yet, reflecting in this respect general trade conditions. Furthermore, he states that, in view of the unprecedented circumstances, it is exceedingly difficult to make any warranted deductions concerning the outlook.

The Dominion Steel Corporation is now operating between 66 2-3 per cent. and 75 per cent. of capacity, and is employing between 2,600 and 2,800 men. The employes are not all working full time, but the labor situation has improved in the last few months because of the European orders received.

Graphitized Metal.—Injecting molten metal into graphite by air pressure gives a new product, known as "graphalloy," which has hardness and strength adapting it to many purposes, and retaining the lubricating property of the graphite. The new material is intended especially for bearings for light machinery, such as small motors, fans and windmills. The metal or alloy used with the graphite can be varied to meet the requirements of any particular use—bronze being most suitable for trolley-wheel bushings, for instance, and copper or copper alloys for electrical apparatus. The graphalloy can be machined into any desired form.

Case and Surface Hardening by the Oxy-Acetylene Process

By C. Royer *

The oxy-acetylene process of rapid heating of machine parts for various purposes is being very generally adopted, not only on account of its wide range of usefulness, but because of the simplicity and portability of the apparatus required and the decreasing cost of the gases used. The two newer applications herein described represent an important development.

WHILE the oxy-acetylene flame has come to be an almost indispensable adjunct of the repair shop, where it lends itself equally well to welding broken parts, building up worn parts, cutting metals, melting lead out of pipe joints, taking apart of shrink fits and many other uses, its application to manufacturing has been somewhat slower though none the less certain and far-reaching. The oxy-acetylene blow pipe furnishes a highly concentrated and very intense source of heat which permits local heating in such good conductors of heat as copper and aluminum, these metals now being successfully welded by this process.

Local Hardening.

The local hardening of tool steel, particularly the high speed varieties, and the case hardening of mild steels opens up a comparatively new sphere for the employment of the oxy-acetylene blowpipe which, as the methods become better known, bids fair to become very important. The most aggressive experimenters in this line are perhaps the French Association of Autogenous Welding whose tests have proved conclusively that the blow-pipe can be used with advantage for case hardening.

It is unlikely that this process will replace, to any extent, that, at present in use but case hardening will now be available to many classes of work heretofore decidedly out of its range of application.. Large pieces requiring but a small hardened area can be successfully treated by heating scarcely more than the surface to be hardened and the consequent expense, warping, and other difficulties incurred by heating the large mass in a coke fire or furnace is obviated. Also, parts already assembled in machines whose removal would entail taking down a large part of the mechanism, can be hardened in place without danger to other parts, the process being so rapid that the heating is purely local and has little time to be transmitted to other parts of the work.

Orthodox Case Hardening.

Case hardening, as is ordinarily practised, consists of carburizing the outside shell of a mill steel casting or forging, thus transforming the outside skin to a high carbon steel which hardens easily upon being quenched. This result is obtained by heating the steel and keeping it, for a certain time, in contact with red hot charcoal or other carburizing substance. The metal absorbs more or less carbon, which absorption is much more rapid if the steel already has some carbon in its composition. Some elements such as nickel and manganese also facilitate the absorption of carbon while, on the contrary, certain impurities such as slag retard the penetration of the hardening substance. For this reason, where good or deep hardening is desired, only the best and purest qualities of steel should be used. About one-half of one per cent. of nickel also gives excellent results.

The rapidity of the process and the depth of penetration depend upon the temperature, and the quality of the case hardening is shown by the depth of the hardened surface. Also, as the percentage of carbon varies from the outside to inside of the surface layer, it is also necessary to take into account the maximum and medium percentages throughout. Case hardening well done should affect a sufficient thickness of the metal treated, and the amount of carbon should decrease gradually from the outside to the inside and should not consist of a film of hard metal without a gradual transition to the condition of the original metal.

The Surface Feature.

When the process is carried out in a closed vessel by means of animal charcoal, carbonate of baryum, cyanide or other organic matter, a very hard and resisting surface is obtained which will not split or shell off because by this method, the decrease of hardness from the surface inward is very gradual and regular. On the other hand, a surface produced by rubbing on the red hot metal, a powder, generally containing ferro cyanide of potassium, gives a very hard thin skin which is liable to flake away during hardening or in service.

The use of the blow-pipe permits the obtaining of either of the above results at the will of the operator by means of suitable handling of the instrument. By using a well-regulated flame to heat the steel and afterwards giving a slight excess of acetylene, one can obtain quick, deep case hardening but it is essential that the inside tip of the flame be kept at a distance of at least one inch from the surface being treated. Being so regulated, the flame contains an excess of free carbon which is very easily absorbed by the metal which is being kept hot by the flame. Again, by keeping the inside tip of the flame too near the part to be heated, a very hard and thin layer of high carbon steel is obtained which is liable to flake away.

Blow Pipe Results.

The following results have been obtained by experiment but, in all cases, care was taken to keep the piece, while being treated, at a cherry-red heat. By the white, inside cone of the flame being kept for two minutes at a distance of five-eighths of an inch from the surface of a piece of open hearth steel, a hardened layer was obtained 0.0197 inch thick and the surface of the metal gave, upon analysis, 2 per cent. of carbon. This is approximately the same condition as is obtained by the use of a chemical powder.

By maintaining the inside flame of the blow-pipe with an excess of acetylene, at a distance of $1\frac{1}{4}$ inches from the surface of the same metal for a period of 10 minutes, the depth affected was found to be 0.1181 inch and the maximum percentage of carbon, that in the outside surface, was not more than 0.85. From this it is evident that, to obtain a deep and evenly graduated treatment, care should be taken to hold the flame far enough from the surface being treated. Otherwise the surface is liable to be transformed into a kind of white cast iron, which is very hard and brittle, and is liable to flake off in the hardening process. It is, therefore, evident that any desired degree of hardness or toughness can be obtained in case-hardening by the oxy-acetylene process by varying the distance at which the flame is kept from the work and the time during which the surface is exposed to the carbonizing flame.

Tool Steel Surface Hardening.

The use of the blow pipe for case-hardening mild steel should not be confused with its application to the surface or local hardening of high carbon and high-speed steel. In the former case the heat of blow pipe is used to maintain the metal treated at a high temperature,

*Manager, L'Air Liquide Society, Montreal.

while, at the same time, the purposely-produced excess of carbon in the flame changes the chemical composition of the steel. In the latter application only the rapid heating power of the flame is utilized as a convenient method of heating a small portion of the surface of a piece of steel, while the rest of the metal is being kept cool by running water or other method.

Surface hardening has received a great deal of attention in England at the works of Messrs. Vickers & Maxim, and has proved to be a cheap and rapid method for the treatment of the wearing surfaces of steel parts. It is applicable to the hardening of the surface of gear teeth, cast steel shafts and boxes, templet holes, and, in general, to the hardening of any small areas upon the surface of large articles, especially in cases where the ordinary process of heating and hardening would cause distortion that would be difficult to remove by subsequent grinding. The lack of warping forms one of the chief advantages of the process. The metal is only heated to slight depth; the surface is cooled as fast as heated, and a very small area is in the heated condition at a single time.

The work to be hardened locally is placed in a tank of water, so that, if possible, the water covers all except the small surface being operated upon. If this is not convenient, it is often quite possible to arrange a stream of water from a hose so as to keep running water on the surfaces which it is desired to keep cool. The flame used should be powerful, and should be held close to the part to be hardened. The flame is directed so that the outer portion flows in the direction along which the blow pipe is being moved. The cooling water is made to follow as closely as possible without interfering with the flame and thus prevent heating.

Speed of Heating.

Special care should be given to the speed of heating and movement of the burner. As the flame passes along, it quickly heats up the surface, which is instantly cooled by the water or by the cold surrounding body of metal, leaving it at the maximum hardness to be obtained with that material. To secure a thin but intensely hard surface, the part to be treated should be barely covered by the water, and the force of the flame should blow the film of water away from the part being heated. This is done by increasing the oxygen pressure.

The normal treatment gives a hard surface about 1-16 inch deep, but greater depth can be obtained by prolonging the heating without burning or oxidizing the surface. This is easily accomplished by moving the flame slightly but rapidly back and forth over the part so that a larger area is heated at once. Experience has shown that no matter how thin or how hard the surface layer produced, it shows no tendency to flake off from the body of the piece.

The process is carried out with the ordinary oxy-acetylene welding outfit fitted with different sizes of blow pipes, care being taken not to employ an oxidizing flame. It is claimed that even cast iron and some kinds of malleable iron can be greatly improved in the degree of surface hardness by being subjected to the same treatment.

The number of uses to which the great heat of the oxy-acetylene flames can be put has grown more rapidly perhaps than the similar development of any other apparatus. The two particular applications above described will, no doubt, open up large fields within themselves and the oxy-acetylene welding apparatus will become more and more an essential part of the modern manufacturing institution, where it will enjoy the same prominence it has held for some time past in the repair plant.

THE "FORD" IDEA.

IN his formal statement constituting replies to a number of written questions submitted by the Federal Commission on Industrial Relations, Henry Ford, president of the Ford Motor Co., of Detroit, Mich., and Walkerville, Ont., made a number of observations relative to his enterprize as well as on employer and employee relationship, the latter of which are of more than ordinary interest. Mr. Ford stated that eight members constitute the company, that its capitalization is $2,000,000, and that last year it did a gross business of between $80,000,000 and $90,000,000, with profits of about $25,000,000. Among others, the following references apply to the employer and employee relationship feature:—

No man can bring up a family and hope to own a home on the ordinary rates of wages.

I do not think any man can do good work mentally and physically for more than eight hours per day.

Theoretically, some persons may argue that we have no right to inquire how a man lives at home, so long as he does his work at the factory, but we are talking of conditions, not of theories. Our experience leads us to conclude, beyond doubt, that the interest taken in employees as to their individual welfare, is most desirable from every standpoint, not only that of the employee and his family, but of the business itself.

The ever-increasing interest developed in our plan by other employers of labor and the individual expressions of the men themselves, which we have taken great pains to learn from disinterested sources, further prove the correctness of our views.

Any manufacturing institution that is successfully making a single product, should increase the business and its plant, and make more work to employ more men.

We cannot expect a man to give us his best efforts when he is in debt and has not enough to keep his family on.

If corporations are over-capitalized they must necessarily oppress labor to make a showing, but if they grow from small beginning, naturally, and stick to one legitimate product, balanced conditions are bound to follow.

The sooner men can be taught that labor is just as much of an asset, and more than machinery and buildings, the sooner labor will be properly recognized.

In my judgment mere business is no objection if corporations are not over-capitalized.

We believe it is better, wiser and more just to make many men comfortable than to make a few very rich.

I have very little use for charities or philanthropies as such. My idea is aid to men to help themselves. Nearly all are willing to work for adequate reward. We have all kinds of cripples in our employ, and they are making good. We have a great many who have been in prison and who are outcasts from society. Every one is making good.

Tariff and Competition.

Speaking also before the commission, Geo. W. Perkins, of the U.S. Steel Corporation, denounced the tariff. He said, "To it is due the depression in the steel industry, as well as in other industries. We need a tariff on a non-political basis," he said. Speaking on the broader aspects of business, Mr. Perkins said:

"I do not believe that competition is any longer the life of trade. Competition, driven to its logical end, gave us the sweatshop, child labor, long hours of labor, unsanitary labor conditions, and bred strife between employer and employee.

"For every ounce of trouble brought about in industry through the selfishness and cupidity of business men, a pound of trouble has been brought about through half-baked laws and mutton-head legislation."

F. C. Gamble, chief engineer of railways for the B. C. Provincial Government, has been elected president of the Canadian Society of Civil Engineers for the year 1915. This is the first appointment of a western member to the presidency of the society, and it will be recognized as a mark of appreciation of Mr. Gamble's untiring work for the advancement and elevation of the profession in Canada.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

DRILL JIG FOR STEEL COLLARS.

By James E. Cooley.

DRILLING and tapping out the screw-holes in the steel collars, so extensively used on studs and small shafts, etc., has always been done by a more or less wasteful method. The type of jig most generally used for the operation is made from an angle plate, having a plug fastened in it, on which the single steel collar is placed to be drilled and tapped. A steel piece, containing a drill bushing is screwed on the plate to guide the tap drill. After the holes are drilled the collars are washed, and then the holes are tapped out. This necessitates a second handling of the collars, and each separate handling, of course, adds to the expense in their manufacture.

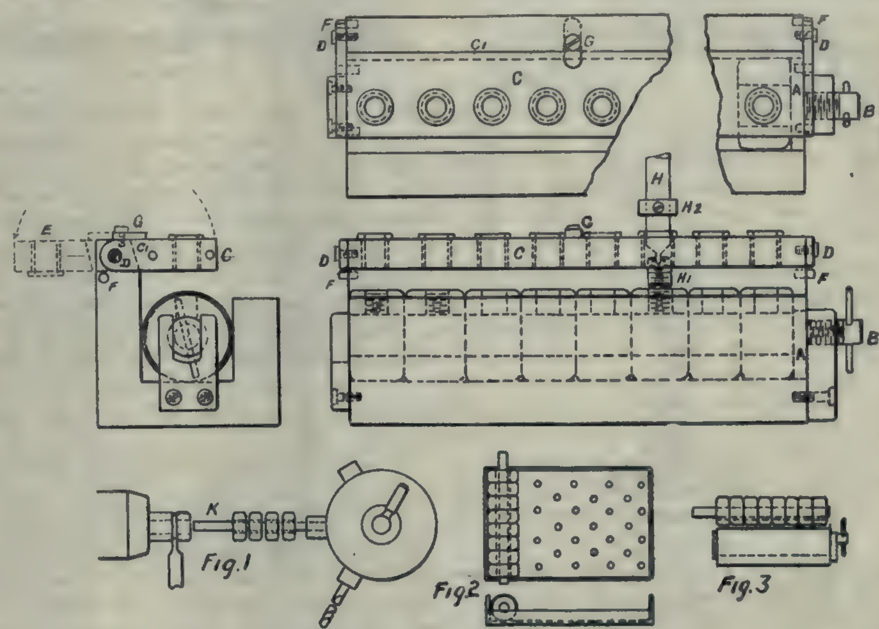
In the enclosed drawing is shown a box jig for drilling and tapping the screw holes in the several collars shown assembled there, also in which the headless screw is placed in the collars in the course of these operations. This jig is used in connection with a four-spindle multiple drilling machine, or a drill press using interchangeable collets and tapping fixture. Three views of the jig are shown; the one in elevation shows eight steel collars held in place by a shoe A and set screw B. A cover C containing the drill bushings is fastened to the sides of the jig by the screws D, on which it is made to swing over, as shown by the dotted lines E, and rests on the pins F. This is necessary in order to have the bushings out of the way when the holes are being tapped out. A button G holds the cover C down on the edge of the jig at C1.

Operation Features.

The construction of the jig can be easily followed without further instructions, but brief descriptions are given concerning the drilling and tapping of the screw holes, order of operations, etc., and also directions to follow in connection with other minor operations in order to produce all the work on the collars quickly, and with the least waste of time. The holes in the drill bushings are made 1-64 in. larger than the screw. The purpose of this is that when the hole is tapped out, a slight burr is made by the top thread on the outside diameter of the collar, and this has to be filed off. If a spotting is made on the collar, the full depth of the point of a drill 1-64 in. larger than the screw, there will be no burr there after the hole is tapped. This does away with one slow operation--that of filing off the burr by hand.

Assuming that a four-spindle multiple drill be used, it is set up as follows:—The first spindle contains a drill for spotting; the next spindle, the tap-size drill; the next, the tapping fixture, and the last spindle, a screw-driver as H held in a chuck. The first operation is to spot all the collars; the next is to drill the holes, the jig still retaining the collars is then dipped in a pail of hot soda and the chips washed out. The button G is turned around, the cover C swung back, and the holes tapped out. Again, the jig with collars are dipped in the soda, and the chips from the tappings are washed out; be put in the hole, only just enough of it to remove the burr. Generally the latter is filed out by hand, also the edges of the shaft-hole are scraped, as a burr is made when the collar is cut from the bar. The reamer eliminates all these operations.

The collars are not taken from a work-box and placed in the jig one at a time, a quicker arrangement than this can be provided. As fast as a collar is cut from the bar after the shaft-hole has been drilled and reamed, as in Fig. 1, they are slipped along on the rod K, which is placed in the turret-head for the purpose. When the rod is filled, it is taken out and the collars are placed in the per-



DRILL JIG FOR STEEL COLLARS.

the cover C is swung forward in position, and headless screws are dropped in each drill bushing, as at H1. The screw-driver is next placed in the bushings, engaging with the slot and sending the screw down in the collar. A stop collar as H2 on the screw-driver regulates the depth for inserting the screw, and the latter should enter down in the collar, within one thread of the shaft-hole.

When these operations are completed, the collars are emptied out of the jig, being finished with but one exception, viz., removal of a burr made by the tap on the inside of the shaft-hole. This is accomplished in a separate operation by reaming out the burr on the drill press. It is the only instance where the collars are handled separately, but the work can be done very rapidly. The whole cutting length of the reamer should not

forated tray shown in Fig. 2. When the tray has become filled with collars it is dipped in the soda water to remove the oil and chips. The collars being still retained in the tray, are carried to the drill press, the rod being inserted through a row of them for the purpose. They are then placed in the jig and the rod removed, as suggested at Fig. 3. One tray will hold a considerable number of collars.

The rod in the turret-head should not be fastened with a screw, as this takes time to undo. The length of the jig, or the number of collars to be contained therein, will be determined by the thickness of the collars. When cutting the collars from the bar, much time will be saved if more than one cutting-off is used.

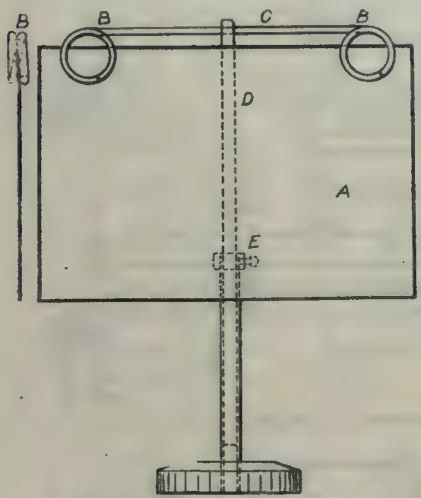
DRAWING SHEET HOLDER.

By E. C. James.

ONE cannot help but notice how carelessly shop drawings and blueprints used by workmen are handled. They are often seen spread out on work benches, tool boxes, and machinery, and as a consequence are easily soiled and torn. Further, drawings are sometimes lost by being blown out of shop windows, and it is not uncommon to see them lifted up by the wind from the bench and glide down gracefully into a machine pan containing oil.

When blueprints and pencillings are once rolled up, it is a hard matter to keep them opened out, as a matter of fact, weights must be used to hold them out flat.

In the sketch herewith is shown a very convenient means for holding a drawing; and which prevents it getting torn or soiled; saves frequent handling and in



DRAWING SHEET HOLDER.

addition has the advantage that the holder can be placed where it is most convenient for reading by the workman. The drawing-sheet A is held between two ring-coils B, formed on the ends of the horizontal rod C. This rod is 1/8 inch in diameter, and fits into the vertical adjusting rod D. The vertical rod is 3/8 inch in diameter and slides in a brass tube attached to the cast-iron base shown. A collar E is attached to the tube and contains the set-screw for the rod D.

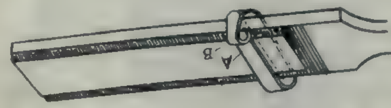
These holders can be made up to suit all sizes of drawing sheets, the rod D being raised or lowered according to the size of the paper to be attached to the holder.

EMERY CLOTH CLIP.

By C. E. Wyllys.

NEARLY every machinist when polishing a piece of work held in a vise, usually places a strip of emery cloth lengthwise around both sides of a file, and holds the cloth in position with the fingers as the file is pushed forward and back. This method has never been satisfactory as the cloth frequently slips from the file.

In the accompanying drawing is shown a useful clip for holding a piece of emery cloth on to a file. It consists of a strip of sheet steel bent over into the form of a clasp and tempered. When



EMERY CLOTH CLIP.

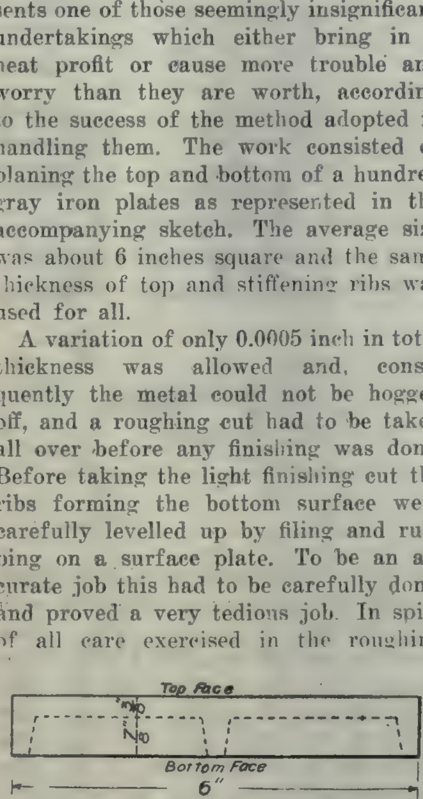
the cloth is placed on the file and drawn tight, the clip is put on and the point A is snapped down over the beaded end B as indicated. To remove the clip, the beaded end B is pushed outward which releases the point A.

LEVELLING UP LIGHT PLATES.

By D. A. Hampson.

THE little job herein described represents one of those seemingly insignificant undertakings which either bring in a neat profit or cause more trouble and worry than they are worth, according to the success of the method adopted in handling them. The work consisted of planing the top and bottom of a hundred gray iron plates as represented in the accompanying sketch. The average size was about 6 inches square and the same thickness of top and stiffening ribs was used for all.

A variation of only 0.0005 inch in total thickness was allowed and, consequently the metal could not be hogged off, and a roughing cut had to be taken all over before any finishing was done. Before taking the light finishing cut the ribs forming the bottom surface were carefully levelled up by filing and rubbing on a surface plate. To be an accurate job this had to be carefully done, and proved a very tedious job. In spite of all care exercised in the roughing



G. I. PLATE FINISHED ALL OVER.

cut, the pieces would rock from 0.003 to 0.004 inch when laid on the plate.

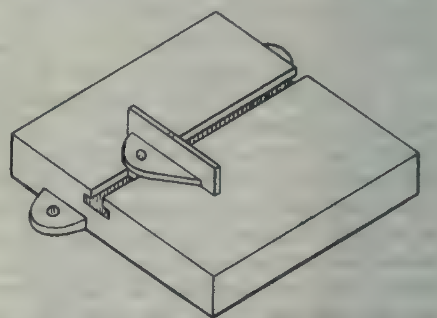
After he had dressed up a few, the machinist on the job grew faint-heated at the magnitude of the task ahead of him and conceived an idea that proved to be a time-saver. Placing the piece in the vise and applying a 24-inch monkey-wrench, he found that, after very little practice, he could give it a permanent set that would correct most of the deformity. The castings could be quickly levelled up by this method to within 0.001 inch of being perfectly flat and further, the set thus obtained was not affected by the subsequent finishing cut.

FALSE TABLE FOR SENSITIVE DRILL.

By A. H. Donald.

THE tables on most sensitive drill presses are rectangular in shape with an unbroken flat surface. A few years of steady service will change this face into one marked by the points of many drills, to say nothing of the holes drilled well into the surface. Continued wear will also cause the table to become convex. In the meantime much time has been spent fastening fixtures with C clamps and other external devices, and in keeping these appliances and preventing them from becoming lost.

After going through these experiences, our firm decided to equip all the sensitive drills with false tables similar to that shown in the sketch. These consisted of light castings well cross-ribbed beneath and having a machined T-slot



FALSE TABLE FOR SENSITIVE DRILL.

across the face. The plate or table is held in place by two top bolts let into the real table in the oil channel section. This false table takes all the wear and effects of rough handling of work and drills, and when it becomes worn or convex it is very easily removed and planed up.

The T-slot is a time-saving feature, and as all the slots are the same, the bolts are interchangeable, and several are kept convenient to each machine for fastening work, jigs or fixtures. Various forms of general labor-saving fixtures can be made at small cost, one of which is shown in place. For instance, a jig set between a couple of these is prevented from flying around and is still free to adjust itself slightly to the movements of the drill. Again, some of our work consists of several holes drilled in a straight line. All that is necessary in this case is to slide the fixture along the groove or, if the work is not clamped, it can be moved along the face of the angle-plate.

Reducing the Coal Consumption in Factory Power Plants

By H. W. Benton

The writer of this series of articles sets forth in plain and easily intelligible language his experience of power plant operating conditions in what might be termed over-average progressive manufacturing concerns, and shows conclusively that in almost every installation there is opportunity increasing efficiency without serious disturbance of existing equipment.

STEAM power machinery has one very great drawback, although not altogether a fault, yet working out to its disadvantage, viz.: the peculiar ability to keep going even when in very bad condition. The apparatus is so "fool-proof" that it will stand much "monkeying with" before it lays down and refuses to go further. This, however, all reflects back to the fuel pile, your coal bill goes away up and you see no visible reason why. To me it is surprising that manufacturers do not awake to the fact that their power cost is too high, and that it can and should be brought down to the lowest possible point, and must be kept there.

Example I.

There is a steam electric power house not very far from Toronto where the coal bill can be cut to the tune of a few thousand dollars per year, without buying any new machinery, just by making each machine work properly and the whole plant in harmony. The steam generators consist of three 300 h.p. Heine water tubes boilers, fitted with chain grate stokers. Two boilers are fired at a time. The engines, two of which are 17 in. x 34 in. x 36 in., cross compound condensing, are of an excellent type and build, and are direct connected to A. C. generators, each of 450 k.w. The average operating conditions, as shown by the power house daily report to the general office for six days last year, were as follows:—

Average load on engines per 24-hour day.		Coal used per 24 hours.
July 21..	902 h.p. per hr.	29.11 tons.
Sept. 21..	828 h.p. per hr.	31 „
Sept. 22..	865 h.p. per hr.	32.10 „
Sept. 23..	790 h.p. per hr.	33.14 „
Sept. 24..	805 h.p. per hr.	32.11 „
Sept. 25..	863 h.p. per hr.	35 „

These figures indicate at once their own incorrectness, and that there is something wrong somewhere. How can 902 h.p. per hour be developed for a 24-hour day on 29.11 tons of coal, and on another day only 863 h.p. be developed with 35 tons of coal? Why should it take 33.14 tons for 790 h.p. per hour and only 31 tons for 828 h.p. per hour?

Again, this plant should develop 1 horse-power per hour at the engine on 1¾ to 2 pounds of coal per hour. To be generous, however, let us take 2½ pounds of coal per horse-power hour. Thus, 790 horse-power per hour would require

$$\frac{790 \times 2.5 \times 24}{2000} = 23 \text{ tons } 14 \text{ cwt.,}$$

or, say, 24 tons of coal.

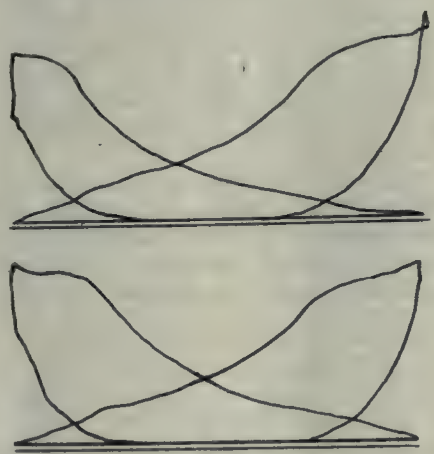


FIG. 1. THE UPPER AND LOWER DIAGRAMS ARE FROM A BROWNELL ENGINE 16 IN. X 24 IN., 175 R.P.M., AND SCALE 50, BEFORE AND AFTER ADJUSTMENT, RESPECTIVELY.

On the particular day, September 23, the report shows coal used as being 33.14 tons. Subtracting the actual coal required as above, 23.14, we get wasted coal amounting to 10 tons, which at $3 per ton means $30 per day, and $900 per month.

FIG. 2. THE UPPER AND LOWER DIAGRAMS ARE FROM AN ERIE CITY ENGINE, 10 IN. X 12 IN., 120 R.P.M., AND SCALE 50, BEFORE AND AFTER ADJUSTMENT, RESPECTIVELY.

An expense of $1,500 or less would put this plant in A1 shape to develop power economically, and still the owners pay the coal bill as though there was no other thing to do. Less than two months' savings of coal would pay all expenses, and the savings would continue for several years.

Example II.

Some time ago I was called to a woodworking factory driven by a Wheelock engine that was only six years old, but, to look at it, one would think it had seen thirty years of abuse. They told me the engine was overloaded, that they could not keep up steam, etc. Less than $60 got new parts for the valve gear, also paid for some machine work and fitting on the valves and valve seats. After adjusting the valve gear, the engine carried the full load satisfactorily, and there was no trouble to keep up the steam pressure required. This small expense for tuning up the engine saved the company the expense of installing a new and larger engine, an additional boiler, smoke stack, etc., which they had come to think would be necessary.

The engine certainly was overloaded, due to the condition it had been allowed to reach, yet the small outlay for repair parts and machine work brought it back to its original capacity, and to-day it is still driving that same mill to everybody's satisfaction. Taking account of present business conditions, you can be sure that the manager is very glad that he has been able to retain his Wheelock engine, and has the cash on hand instead of invested in a larger power plant.

Example III.

At a certain lumber mill working all kinds of large timbers, both rough and dressed on the ground floor, with the upper floor rented to a box manufacturer, the machinery was all driven by one engine—a Monarch Corliss, with double eccentric valve gear. The engine was supplied with steam at 90 lbs. per sq. in. pressure from one return tubular boiler. Both the engine and boiler were in one room, and the former was so close to the latter that the fireman could turn around after putting on a fire and lean his shovel against the engine cylinder just as conveniently as to lean it against the wall.

An engineer and fireman were employed to operate this small outfit, and at one time the refuse from the mill more than supplied the necessary fuel. In addition, shavings were baled and sold. A time arrived, however, when there were no shavings to bale. All refuse was used for fuel, and coal had to be bought to make up what the refuse was not sufficient to secure. This plant,

in a word, went down from "no coal to buy and shavings to sell" to "no shavings to sell and coal to buy."

The main cause of the trouble lay in the engine valve gear, which had been altered so that the engine wasted an enormous quantity of steam. In spite of this, the wheels kept turning, and the

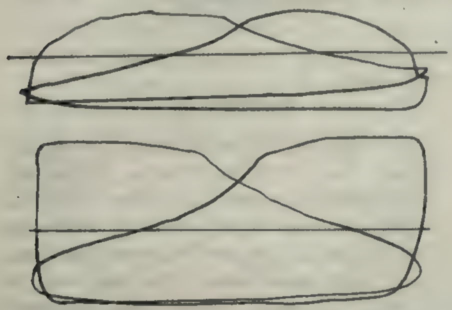


FIG. 3. THE UPPER AND LOWER DIAGRAMS ARE FROM A LOW-PRESSURE CONDENSING ENGINE, 34 IN. X 36 IN., 60 R.P.M., BEFORE AND AFTER ADJUSTMENT RESPECTIVELY.

only difference noted by the owners was that the fuel bill had grown.

About five hours' time was devoted to the correct adjustments of the engine valves and valve gear, with the result that the shaving baler again became necessary, and the coal purchase brought to a finish. In one week's time the fireman was paid off, the engineer did his own firing and received an increase in pay. Neglecting the fuel cost altogether, and assuming the fireman to be paid $12 per week, and that the engineer had $5 per week more, then the net saving in wages alone was $7 per week, or, say, $350 per year. If we add to this the saving of coal plus the income from the sale of shavings, less the cost of baling, etc., we have a very nice sum of money to the credit of the plant as a result of a very small outlay to tune up the engine.

The diagrams in Fig. 4 show the condition of the valves before and after adjustments.

Example IV.

Figs. 1 and 2 were taken from engines as stated, and show conditions before and after adjustments. Both engines were fitted with single valves of the balanced slide valve type, and the regulation was by shaft governors. Two boilers were steamed in this plant, and the fireman had to keep close to his job to maintain the necessary pressure. After making the adjustments shown, there was a decided improvement apparent in the boiler room, due to the boilers steaming much easier.

Example V.

Fig. 3 shows diagrams from the low pressure cylinder of a cross-compound condensing Corliss engine. The first diagram shows the valve adjustment as I found it. In this condition, the engine would not carry its full load unless the live steam by-pass to the receiver was open. As the load would drop off, some one had to run and close the by-pass, then open it a little, and so on. One man was kept busy opening and closing the by-pass valve and oiling the engine.

It can readily be understood that such a method of operation was very poor; eating up a great amount of fuel, besides making the regulation of the engine speed as undesirable as possible. After a few alterations to the valve gear of the low pressure cylinder, the second diagram was obtained, and in this condition the operation of the engine was very satisfactory. The by-pass to receiver was never used while the engine was in operation, and only so for "warming up" before starting, or sometimes in starting up to supply steam to low pressure side to pull the high pressure side off the dead centre. The engine governor now has a chance to perform its work and the speed regulation is satisfactory.

Regarding the fuel, as there was no record of fuel before and after, I cannot state definitely the saving made, but can state that there are three boilers of equal size in the boiler house, and two

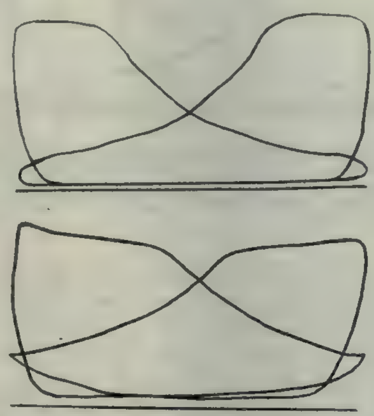


FIG. 4. THE UPPER AND LOWER DIAGRAMS ARE FROM A DOUBLE ECCENTRIC MONARCH CORLISS ENGINE, 20 IN. X 36 IN., 100 R.P.M., AND SCALE 40, BEFORE AND AFTER ADJUSTMENT RESPECTIVELY.

are used at a time. If the condenser gave trouble, the three boilers were fired to keep steam under the old condition. but, after adjustment of low pressure cylinder, only two boilers were ever used, no matter whether the condenser was on or off. It should be abundantly clear that there must have been a saving of fuel, for a 2-in. by-pass line cannot be open, say, for five hours per day blowing steam into a receiver without using up considerable coal. Hence if by correcting the defective adjustments the 2-in. line is not now used, its equivalent in fuel must have been saved.

Example VI.

Fig. 5 is from a slide valve engine. Diagram No. 1 was obtained with the throttle wide open and governor belt off, engine loaded, and running 160 r.p.m. The diagram shows an improperly designed slide valve.

Two hours' work in a machine shop altered the valve, correcting the defects and, after adjustments were made, the engine would run away with the load that before held it down to 160 r.p.m.

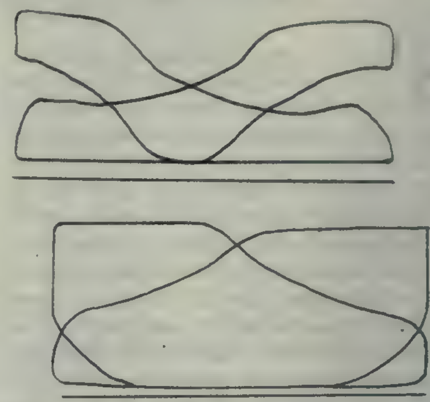


FIG. 5. THE UPPER AND LOWER DIAGRAMS ARE FROM A SLIDE VALVE ENGINE, 8 IN. X 12 IN., 160 R.P.M., AND SCALE 40. BEFORE AND AFTER ADJUSTMENT RESPECTIVELY.

After alterations, the engine carried the load at 160 r.p.m. with the throttle valve open two-thirds of a turn instead of wide open. The second diagram shows the steam distribution after alterations.

SIGNIFICANT FIGURES.

ARISING out of and embraced within the contents of the preliminary reply made by Sir Edward Grey, Britain's Foreign Secretary, to the United States Note concerning export shipments, it appears that these from New York to Denmark amounted in November, 1913, to $558,000, while those of the corresponding month of 1914 to that country amounted to $7,101,000. Exports to Sdewen rose from $377,000 to $2,858,000; those to Norway from $477,000 to $2,318,000, and in the case of Italy from $2,971,000 to $4,781,000. The American Government were also reminded that copper exports from the United States to Italy from the beginning of the war up to the end of the third week in December amounted to 36,285,000 lbs., as compared with 15,202,000 lbs. for the corresponding period of 1913, and that those to countries which are grouped together in the official returns under the heading "Other Europe"—which includes Norway, Sweden, Denmark and Switzerland—stood at 35,347,000 lbs., as against 7,271,000 lbs. in 1913. This is quite enough. No further argument whatever is needed. If innocent American trade suffers any injury the responsibility lies entirely at the door of those American traders who—as the above figures prove—have been supplying our enemy with the munitions of war.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

STRIPPING PLATE JOLT MACHINE.

ANNOUNCEMENT is made of a new Osborn molding machine which automatically performs practically all of the operations necessary to mold-making, except shoveling of the sand, and is especially adapted for the making of moulds for journal boxes and work of a general nature. It of course delivers a better quality of mould than hand-work, reduces waste to a minimum, is very much easier at every step, and materially lessens labor cost, as skill is not an important qualification for the operator.

The apparatus is known as the Osborn Stripping Plate Jolt Machine No. 450, and is adapted to use with any of the standard types of stripping plate equipment in any size. As the pattern is drawn through the plate by power, accuracy is a feature on which much stress is laid. One of the most obvious advantages of the machine is the speed at which moulds are made—taking a single mould or, more particularly, continuous operation. The mould is automatically jolted and stripped much more quickly than by hand, and as all operations are positive, speed is further enhanced thereby.

The table size can be varied, which is sometimes desirable where the machine is to be used on one particular pattern, the advantage being that with the table made about 1/8 inch less than the flask sizes, the sand does not pile up on the table; or in other words, does not require the brush or blowing off of the sand before returning stripping plate to position.

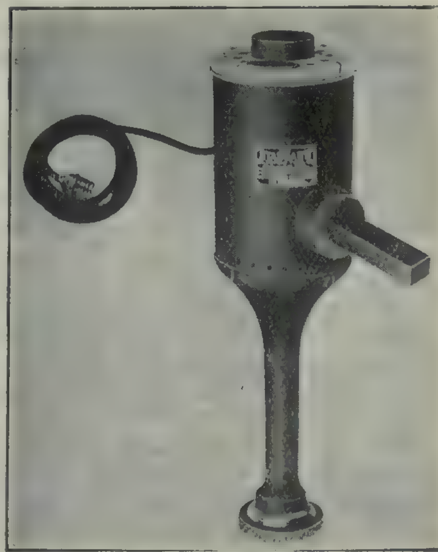
JOLT STRIPPING PLATE MACHINE READY TO RECEIVE FLASK.

Jolt.—The construction of the jolt is similar in all respects to the Osborn No. 100 plain jolt machine, being equipped with the Osborn air cushioned balanced jolt valve.

Drawing Mechanism.—The draw cylinders are cast in one piece and connected to the base of the machine by large fitted bolts. These cylinders extend below the base and are so designed as to set inside of 8 inch pipes inserted in the foundation. The piston rod, which is also the guide rod, is planed on the side and provided with gear teeth which mesh with pinions cut from a solid shaft extending from one cylinder to the other. Both this pinion shaft and the guide rods are entirely enclosed and self-oiling, while the pinion shaft is used to prevent one rod traveling faster than the other.

Air-Operated Flask Clamps.—The machine is provided with clamps operated by air in order to rigidly lock the flask and stripping plate to the table of the machine. This is not always required, but on certain classes of work it is found to work to great advantage. A bale swings over the end of the flask—the bale being made of spring steel, in order to compensate for unevenness in the height of flasks. The machine is fitted complete with all piping, valves, lubricators, etc., ready to set on the foundation; the purchaser only being required to bring his air line to the machine.

In operation. After the flask has been filled and jolted, the air is turned into the draw cylinders this rapidly stripping the flask and stripping plate upward from the pattern. After lifting mould away, the valve handle is thrown to the opposite position, which supplies air above the piston, rapidly returning stripping-plate ready for the next mould. This is an important feature of the machine, as it is not necessary to await the exhaust escaping from below the cylinder and then depend upon gravity for the return. In many instances it has been found that gravity is not sufficient to overcome the wedge action caused by sand between the pattern and stripping-plate. Both the stripping and lowering action are equally as fast as that of hand-power on the old-style machine.



NEW INTERNAL GRINDER.

The rated and maximum stripping capacities with 80 pounds air pressure are 800 and 1,000 pounds respectively, while the maximum jolting capacity is 1,200 pounds. The standard table size is 19 3/8 inches by 32 inches, the pattern draw 14 inches, and the height of table from floor 24 inches.

NEW INTERNAL GRINDER.

THIS new grinder has been designed for grinding gasoline engine cylinders, air cylinders, etc., and has, it is claimed, been found very effective for that class of work. It is attached to tool post on lathe where it can be held rigid. The Universal motor is used which operates on both alternating and direct current and low frequency circuits such as 25, 30 and 40 cycles, being particularly adapted to all of these and interchangeable on either. The grinder is fitted with an emery wheel 3½ inches in diameter by 1 inch face and the motor has a speed of 7,000 r.p.m., which makes this tool especially adapted for internal work as the surface speed of emery wheel is approximately 6,000 ft. per minute.

This grinder is ball-bearing equipped throughout, the double roll S. K. F. bear-

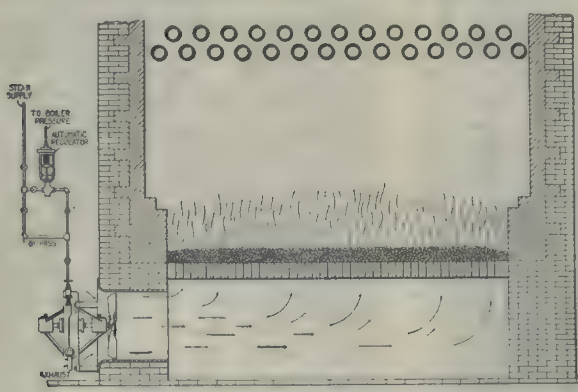
ing being used. Armature shaft is extremely rigid, thereby preventing clatter of the emery wheel. Three ball bearings are used to support the shaft. The capacity of motor is $\frac{1}{2}$ h.p., it being form wound and impregnated in Bakelite, which insures against forms of motor trouble incident to high-speed electrical apparatus if constructed according to slow-speed motor practice. The weight of tool is 35 lbs., and can be operated off any incandescent lamp socket or it can be attached to power circuit.

The Standard Electric Tool Co. are manufacturing and placing this product on the market.

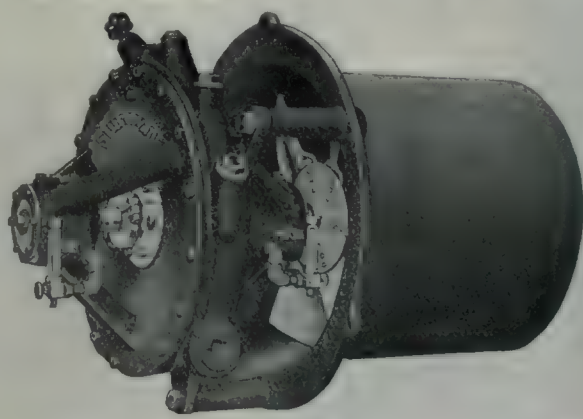
30-TON HYDRAULIC PIPE BENDER.

THE illustration shows a press which was primarily designed for bending pipe of various sizes. The press is however, also adaptable for miscellaneous work required in machine, railroad and automobile shops such as bending and straightening axles, small structural shapes, bars, shafts, etc. By the use of bending blocks, pipe up to 4 inches in diameter can be bent, and clamps are provided for attaching the press to a stanchion which has a maximum diameter of 5 inches.

The material of the press is of steel throughout, the C frame and bending bed being cast in one piece. The top of the C frame is provided with a ring into which the cylinder sets, and when the cylinder is received into this ring and turned to its desired position it is keyed into place. There is an advantage in having the cylinder set in a ring in this manner, because it can be placed in any position desired, bringing the handle of the rack and pinion to the point most convenient to the operator. Another feature about the press which makes it very convenient consists in the bending blocks being changed without the use of wrenches, screws, etc.



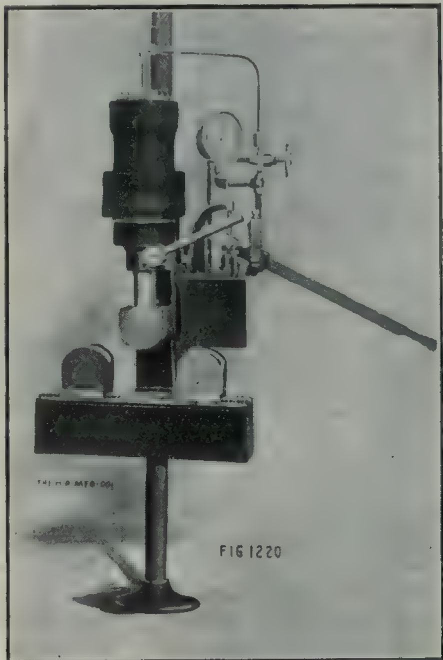
STURTEVANT TURBO UNDERGRATE BLOWER ARRANGEMENT.



STURTEVANT TURBO UNDERGRATE BLOWER.

The ram of this press is forced downward by a hand operated pump, with a plunger diameter of $\frac{5}{8}$ inches and a stroke of $3\frac{1}{2}$ inches. The pump is equipped with a $\frac{1}{2}$ inch safety valve and $\frac{1}{2}$ inch T wheel operating valve. The reservoir is part of the pump. A hand operated pump is considered desirable on an hydraulic press of this kind because there is no danger of over-bending the pipe.

Again by the use of hand power a



30-TON HYDRAULIC PIPE BENDER.

rapid movement of the ram may be obtained at the start when it is most desirable, and when the bend has almost reached the predetermined point, any desired speed of the ram can be developed. This is particularly advantageous because it produces just the character of bend wanted. The rack and pinion is provided for the rapid movement of the ram to the work before the pump is operated. The downward movement of the ram fills the cylinder with fluid and the upward movement returns the fluid to the water box. In this manner there is no lost motion in the operation of the pump. A maximum pressure of 30-tons is developed on the press.

The ram has a diameter of 6 inches and a run of 9 inches, and the pressing bed which receives the bending blocks is 27 inches long with a pressing width of 8 inches. When the ram is returned the distance from the top of the cylinder to the head of ram is $24\frac{1}{2}$ inches, and the daylight between the ram head and pressure bed is $14\frac{1}{4}$ inches. The height of the press over all is 3 ft. 11 inches.

This particular press is a new design recently developed and added to the line of hydraulic machine tools manufactured by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

TURBO UNDERGRATE BLOWER

THE necessity for more furnace draft often arises in the case of existing steam power plant installations and, to meet such contingencies, the B. F. Sturtevant Co., of Galt, Ont., and Boston, Mass., have placed on the market a new design of turbo undergrate blower, compact and self-contained, so that it can be installed in the boiler brickwork with the minimum of expense and least interference with the plant operation. In its general features it is practically identical with the large standard turbines made by the company, the bearings being provided with oil-ring lubrication, while a floating metallic stuffing-box prevents steam getting in them and allows of 15 pounds back pressure being carried. This turbo blower is controlled by from one to six nozzles according to the amount of steam required, the fireman regulating the steam consumption for any particular load by shutting off one or more nozzles.

James W. Leonard retired from the position of assistant to the vice-president of the C. P. R. last Monday. Mr. Leonard will take up his office as head of the Toronto Terminal Co. at once. This would indicate the early resumption of active operations in the construction of the new Union Station.

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PRINCIPAL CONTENTS.

CANADA'S WAR ORDERS.

IS Canada getting her full share of war orders? This question can be answered quite emphatically in the negative. Although irresponsible statements have been published in the press to the effect that contracts have been placed in this country amounting in the aggregate to $200,000,000 it can be stated authoritatively that the total does not exceed $50,000,000, that being an outside figure, covering everything. Many manufacturers who are in a position to fill orders and who are prepared to do so at the lowest price compatible with a satisfactory product, have not received a dollar's worth of business, while orders have gone to American firms, which they were equipped to handle.

It is highly necessary that business within the Empire be maintained at as close to normal as conditions permit. War orders placed within the Empire mean the retention of the money and a consequent increased circulation. If "silver bullets" can win the war, the placing of war orders at home is an essential step to the victory of the British cause.

The arrangements for the placing of British and allied war orders in Canada are good as far as they go. Orders for shells and ammunition go through a committee and it is understood that all factories which can handle such orders are being worked to capacity. Orders for uniforms are handled separately. All other contracts are handled by Frederick Stobart who has been placed in Montreal as accredited representative of the British War Office with full powers to act. Mr. Stobart, who is a Canadian business man of high standing and recognized probity, does not receive remuneration for his services. That he has done his work well and fairly is a statement that needs no defence. The system is, briefly, as follows:

Samples and specifications for supplies are sent to Mr. Stobart who then gets tenders from Canadian manufacturers. Where quality and price are right, orders are placed. No other considerations enter into the letting of contracts. Political affiliations and personal pull have been eliminated. Do the arrangements thus made go far enough? Does the War Office offer, through Mr. Stobart, as much work as the Canadian manufacturers are in a position to handle? Are not contracts awarded to United States firms without any consideration as to whether they could be carried out in Canada? These are questions that the business men of Canada are asking; that the Dominion Government should ask.

It is a fact that individual manufacturers have gone to London with representations on their own behalf. The Canadian shoe manufacturers have formed an association and sent a delegation to London, but up to the present this has resulted in little business. It is said that the Dominion Government offered its services but that the offer was politely declined.

The situation then is this. The efforts made to secure more business from London have demonstrated that Canada is not getting as large a share as the country is in a position to handle. The lack of success attending these efforts shows that the matter **has not been handled in the right way**; for the Imperial authorities are fully alive to the value of placing contracts within the Empire.

The question to be decided then is: How best can Canada's case be presented? The answer is not hard to find. The Government should lead the manufacturers in a determined, comprehensive campaign with the object of securing for Canada the maximum of war business. Let the Minister of Trade and Commerce fulfil the real functions of his office by organizing a campaign, backed by the full weight of Government authority and prestige, to place Canada's claim before the authorities at London. Let the Dominion Government say to the War Office: "We can handle such and such a share of your requirements, and we will guarantee quality, price and satisfactory delivery. By giving us as much of the business for the British and allied armies as we can handle, before sending orders abroad, you will not only keep the flag of prosperity flying, but aid and abet enthusiasm towards the overthrow of German despotism."

This is the duty of the Department of Trade and Commerce at the present juncture. Is anything being done?

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X.......	18 00	17 00
Victoria, No. 2 Plain..	18 00	17 00
Hamilton, No. 1.......	18 00	17 00
Hamilton, No. 2.......	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal.	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 9 00
Copper, crucible........	10 00	10 00
Copper, unch-bled, heavy	9 50	10 00
Copper wire, unch-bled..	9 50	10 00
No. 1 machine compos'n	8 50	9 00
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	4 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 5 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in. ..	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in. ..	70%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload ..	$15 00	$15 00
Electrolytic copper	15 00	14 75
Castings copper	14 50	14 50
Tin	38 50	37 50
Spelter	7 50	7 50
Lead	4 75	5 00
Antimony	18 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Jan. 8, 1915:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
	Standard			
¼, ⅜ in.	65½	50½	....	....
½ in.	70½	59½	....	....
¾ to 1½ in. ..	75	65	....	....
2 in.	75	65	71	61
2½ to 4 in. ..	75	65	74½	64½
4½, 5, 6 in. ..	....	....	72½	62½
7, 8 10 in.	....	....	69	58
	X Strong P. E.			
¼, ⅜ in.	58	48	....	....
½ in.	65½	55½	....	....
¾ to 1½ in. ..	69½	59½	....	....
2. 2½, 3 in. ..	70½	60½	....	....
2½ to 4 in. ...	....	....	67½	57½
4½, 5, 6 in. ..	....	....	67½	58½
7, 8 in.	....	....	60½	49½
	XX Strong P. E.			
½ to 2 in.	44	34	....	....
2½ to 4 in. ..	....	....	44	34
	Genuine Wrot Iron.			
⅜ in.	59½	44½	....	....
½ in.	64½	53½	....	....
¾ to 1½ in. ..	69	59	....	....
2 in.	69	59	65	55
2½, 3 in.	69	59	68½	58½
3½, 4 in.	....	....	68½	58½
4½, 5, 6 in. ..	....	....	65½	55½
7, 8 in.	....	....	62	51

Wrought Nipples

4 in. and under	80%
4½ in. and larger	75%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.68
Linseed oil, boiled, single bbls.	0.71
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

1/4 inch	$7.25
5/16 inch	5.10
3/8 inch	4.35
7/16	4.05
1/2 inch	3.80
9/16 inch	3.80
5/8 inch	3.65
3/4 inch	3.60
7/8 inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 09¾
X Grand	0 09¼
XLCR	0 08¾
X Empire	0 08
X Press	0 07¼
COLORED.	
Lion	0 06¾
Standard	0 06
Popular	0 05½
Keen	0 05
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 06½
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06
Dark Colored	0 05

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 1, 1915.—The general situation, in the iron and metal trade after the expiration of one month of the new year, has undergone but little change. As compared with December, the January sales have not shown any appreciable increase. However, there seems to have been an increased number of inquiries, although these have not as yet resulted in the placing of any large volume of business. The foundry business is extremely dull, while the market for machine tools is also more or less quiet. The equipment of most factories has been more than sufficient to take care of the diminished amount of business moving at the present time.

In metals there exists more or less activity on account of the demand for munitions of war both on this continent and in Europe.

The Steel Trade.

The railways, which have always figured largely in the consumption of steel rails and other products of rolling mills, have suffered severely by the general curtailment of business, hence they are placing but small orders for steel and equipment. The demand for merchant bars has greatly decreased, yet activity in this feature is as marked as any. The demand for building sections has been very small. However, all indications at present point to a revival in the early spring.

Canadian and American bridge and construction companies have representa-

tives in Europe at present, with the idea of securing business for their respective firms.

Pig Iron.

Little or no trade in pig iron has been moving since the beginning of the war. British iron has all been kept for domestic consumption at home. The price of pig and ore in Britain, suitable for producing steel, has risen considerably, due to the increased demand by the Admiralty and War Office. The increased freight rates and insurance premiums on ore from Spain, Norway, Sweden and Algeria have also tended to increase the price. American business is dull and the price rather low.

Machine Tools.

The demand for machine tools is extremely light. However, the situation is rather unique, because there is an ever-increasing number of shops entering into the manufacture of steel shells, and plants endeavoring to equip themselves for this class of work have been purchasing more or less heavily. However, the volume of business passing as compared with that of previous years is small. The supply business continues much the same from week to week. Orders are constantly being received, but they are generally small.

The Metals.

Owing to the demand for war materials being ever on the increase, the metal situation contains many interesting features. Copper still presents a very strong appearance. Many factors, of course, influence copper prices; the European demand and reduced production being the principal contributories.

Spelter is quite strong, and at the moment no large quantity can be purchased for immediate delivery. The prices for smaller amounts have jumped up ¼ of a cent per pound the last week. Tin also has taken a jump up of ½ a cent a pound. The increasing demand has been, of course, responsible for the upturn. Lead remains very quiet. The antimony increase in price has not yet been reportel, but the market is strong and the supply limited. Aluminum, like lead, has not been very active during the week.

Toronto, Ont., Feb. 2, 1915.—General trade conditions are practically unchanged, although the outlook is perhaps a little brighter. The majority of those factories which are not working on Government orders are quiet. War business, however, is developing, and has already assumed considerable proportions, and will help to offset the loss of business through ordinary channels. The heavy demand for foodstuffs is also tending to keep up the volume of trade.

The yearly balances of manufacturing concerns for last year do not show up favorably as compared with the previous twelve months, but this cán hardly be wondered at, considering the conditions which prevailed, especially the last five months of 1914. There is considerable speculation as to what lines will be affected by the new budget and to what extent the tariff will be increased. The necessity of increasing the revenue of the country is recognized, and higher duties will no doubt be accepted without much criticism.

Conditions in the steel trade continue quiet, reflecting other industrial conditions. The scrap metal market is dull and prices are unchanged. There is continued activity among machine tool dealers on account of the increased demand for tools for making shells. A new price list for waste is out, cotton wastes are cheaper and wool wastes have advanced. The metal markets are firm, tin and spelter having advanced 1c and ½c per pound respectively. The local demand is light, but improving in volume.

EQUIPMENT FOR VICTORIAN RAILWAYS.

Tender forms are open to the inspection of Canadian manufacturers at the Department of Trade and Commerce, Ottawa, for the following equipment:—

28,295—71 tons steel channel bars (as per drawing).

27,517—1 high-speed lathe, with tools and accessories.

The last mail available for the tender closing at Melbourne on March 24 is that scheduled to leave Vancouver (envelopes should be endorsed "via Vancouver") on February 17 and due at Melbourne on March 13. The last mail for the tender closing at Melbourne on April 7 is that leaving San Francisco (envelopes should be endorsed "via San Francisco") on March 3 and due at Melbourne on March 31.

Steel Market.

There is nothing of particular interest to note in the iron and steel trade this week; business is still quiet, more or less on account of a similar general condition. A fair amount of business has been booked for European account, but it has been stated on good authority that the margin of profit is small, and considerable difficulty is being experienced in obtaining ships to carry the goods. The building trade shows no improvement, but there is a little better demand for merchant bars from manufacturing interests. There have been no price changes and the market is firm.

The steel trade in the United States is gradually improving and prices on bars, plates, and shapes are holding firm. Galvanized sheets have advanced $3 per ton on account of the high price of spelter.

Pig Iron.

The market is dull and demand light. Most foundries continue to work considerably under capacity, and are buying to fill immediate requirements only. Prices are unchanged.

Machine Tools.

There is considerable activity in machine tool circles on account of the demand for equipment for making shells. Several nice orders have been booked this week by local machinery dealers, and further developments are expected. Further orders for shells have been placed recently, and in almost every case special tools have to be purchased. This being the case, there will be a continuance of good business in machine tools for some time to come.

Supplies.

The chief item of interest this week as regards supplies is the change in prices of cotton and wool waste. The new list is given in the selected market quotations, from which it will be noted that all cotton wastes have been reduced on account of cheaper cotton; on the other hand, wool wastes have advanced, the raw material being higher. Linseed oil is unchanged, but higher prices are anticipated on account of the continued advance in flax-seed. The demand for supplies generally is light, although an improvement is noticeable.

Metals.

There is a little better demand for metals in the local market. Prices are firm all round, tin and spelter having advanced 1c and ½c respectively. The copper market is very firm and exports are heavy, practically all being taken by the allies. Production is being increased at the mines, and is now probably 75 per cent. of normal. Copper advanced slightly in London, but the local market is unchanged at 15c per pound. Tin has advanced in London, which is attributed to manipulation. In the local market tin has advanced 1c, being now quoted 37½c per pound. Spelter continues to advance and present prices are nominal. The price is ½c higher, being quoted at 7½c per pound. Lead is strong at advanced prices in the primary market, due to big business. The local market is unchanged at 5c per pound. Antimony is firm and unchanged at 18c per pound, while aluminum is also unchanged at 22c per pound.

RUBBER SHIPMENTS TO UNITED STATES

THROUGH the efforts of the Rubber Trade Association of London and the Rubber Club of New York, arrangements were perfected for a second shipment of 1,000 tons of rubber, to go forward last week to the British Consul in New York. The consul will apportion the rubber among manufacturers who sign a guarantee that the resultant product from this shipment will not be exported to Germany or Austria.

The Rubber Trade Association hopes that at least 1,000 tons of rubber will be shipped monthly under the same conditions for the benefit of American manufacturers other than the large concerns which gave heavy bonds enabling them to procure all the rubber desired from London. The association felt that some such action was necessary to prevent a few large American concerns from obtaining entire control of the market. Ordinarily about 3,000 tons of crude rubber is stored in London, but the present amount is estimated at about 8,000 tons, as a result of the embargo on its exportation. Trade experts estimate that America normally requires 40,000 tons annually, of which about two-thirds is supplied from London.

The Rubber Exports Committee named by the Government to provide a plan for regulating exports during the war is attempting to formulate a more permanent method for handling American business in such a way that Germany will not obtain the manufactured goods. In the meantime, the Rubber Association believe that American manufacturers properly vouched for will be able to obtain supplies from the shipments which leave under special Government permits. Experts estimate that 1,000 tons of rubber monthly will be sufficient to keep the American factories operating around normal capacity.

STEEL CO. OF CANADA CONVENTION.

ON January 13, 14 and 15, the Steel Company of Canada, held its third annual convention of sales managers, works managers and salesmen at Hamilton, Ont., representatives being present from as far east as Halifax to as far west as Winnipeg. The convention was in charge of Robert Hobson, the general manager, assisted by F. H. Whitton, assistant general manager, and R. H. McMaster, manager of the Montreal plant. The president, Chas. S. Wilcox, and the vice-president, Cyrus A. Birge, were present at the various sessions.

The business of the convention was devoted to practical demonstration of sections of the company's plant, while special attention was given to the various papers presented.

The business outlook was also touched on, and the general opinion was favorable to a better year ahead than was anticipated a few months ago.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Cancoma.

British West Indies.

E. H. S. Flood, Bridgetown, Barbados, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Canacom.

Harrison Watson, 72 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Strathroy, Ont.—Howard Statham has opened a machine shop on Frank street.

London, Ont.—The Dennis Wire & Iron Works Co. will equip a factory which they have recently purchased.

Montreal, Que.—Work is progressing on the new pumping station. An overhead travelling crane will be required.

Campbellford, Ont.—It is reported that the Dickson Bridge Works will be awarded a contract for shrapnel shells.

St. John, N.B.—The Lehigh Valley Coal Co. has acquired a property and dock at the waterfront at a cost of $15,000.

Sarnia, Ont.—The Mueller Manufacturing Co. is now working on the brass parts of shrapnel shells for the British Government.

Leamington, Ont.—The Pelee township council are in the market for a boiler for the pumping station. Alex Baird is engineer.

Ingersoll, Ont.—The Ingersoll Machine Co., recently organized, has taken over the Wilson & Short factory. Mr. Wilson is manager of the new concern which has received an order for shells.

Humboldt, Sask.—The installation of the civic waterworks pumping plant has been completed and is ready for operation. The sewage pumping station is completed with the exception of the machinery.

Welland, Ont.—Thos. B. Allen, of Toronto, appeared before the Council on January 25, presenting a proposition for the location of a factory to manufacture emery. Mr. Allen wished to know what inducement the town would offer the company to locate.

Montreal, Que.—It is reported that the Canadian Steel Foundries, Ltd., have secured the contract to manufacture the castings for twenty submarines to be built by the Canadian Vickers, Ltd., for the British Government.

New Glasgow, N.S.—It is reported here that the Canada Tool & Specialty Co. have made arrangements to make rifle sights for the Ross Rifle Co. of Quebec. R. H. Mackay is interested in the former company.

Lindsay, Ont.—Richard Sylvester has made a request to the council for a loan of $10,000 for the purpose of enlarging his plant. The Sylvester Mfg. Co. makes gasoline engines and pumps, and propose to make traction engines in addition.

Chesley, Ont.—The Canadian Bed Co. has received a $100,000 order from the Government to make 25,000 shrapnel shells. The company is installing $12,000 worth of new machinery, so as to be able to start on the order by March 1. G. M. Griffin is the manager.

Lucknow, Ont.—The Bag Holder and Machine Co. has been incorporated as the Sepoy Manufacturing Co., with capital of $20,000. The charter members of the new company are: John Joynt, Dr. G. A. Newton, Frank Tate, W. G. Andrew, George H. Smith, Joseph E. Agnew and W. J. Wraith. The charter authorizes the manufacture of bag holders, trucks, wheelbarrows, etc.

Chatham, Ont.—A new proposition has been received from the Augustine Automatic Rotary Engine Co. of Buffalo, N.Y., who have been negotiating for the purchase of the Defiance Iron Works plant. The new proposition is one that meets the approval of the Board of Trade and the city council, and it is quite likely that the deal will be closed in the course of a few days.

Quebec, Que.—The Ross rifle factory has contracted to furnish the Russian Government with 3,000,000 rifles during the next two years. It will also supply England and Canada with 500 rifles per day simultaneously. The plant, which has already been doubled since the outbreak of war, will be doubled again this year, when it is expected that some five thousand men will be given employment.

Sarnia, Ont.—The Sarnia Electric Co. is now installing a 1,250 horsepower steam turbine generator and attachments. This outfit was made by the Canadian Westinghouse Co. of Hamilton. When the new machinery is completed the company will have a capacity of 2,500 horse-power, which is quite sufficient to meet the needs of Sarnia and Point Edward for some years to come.

Arnprior, Ont.—A. G. Munich, manager of the lead mine of the James Robertson Co., on Chats Island. Fitzroy, was in Arnprior on Jan. 27, when he met the local Board of Trade and placed before them a proposition for the establishment of the company's proposed smelter and concentrating mill. The proposition in brief is—the company will erect a tram line from the mine to Arnprior, build the smelter and concentrator, and employ from 200 to 500 men, the town to issue 40-year bonds for about $100,000.

Electrical

Hamilton, Ont.—Chairman Ellis, of the Hydro-Electric Commission, announced on January 30 that a cut in rates would be made in a short time, but he was unable to state the amount.

Bolton, Ont.—The advent of Hydro-electric into this village was celebrated at the town hall on Jan. 26. Reeve F. H. Leavens presided over a large and enthusiastic meeting. J. J. Porter, Warden of Peel County, pressed the button.

Kirkton, Ont.—St. Mary's, Exeter, Granton, and intervening municipalities were well represented at a most enthusiastic hydro radial meeting held in the town hall on Jan. 27. Resolutions were unanimously passed approving the plans of the Hydro-Electric Commission and pledging support in the carrying out of those plans in this district.

Ilderton, Ont.—The village on Jan. 25 carried by a large majority a by-law authorizing the trustees to enter into a contract for current with the Hydro-Electric Commission of Ontario. The vote was 29 for the by-law, seven against. The transmission line to serve Ilderton runs from London to Lucan and is already well on to completion.

St. Catharines Hydro-Electric.—The annual report of business of a portion of the first year's operations of St. Catharines Hydro-Electric Commission shows a gross surplus of $1,915.98, and allowing for a depreciation charge of $850, makes net surplus of $1,065.98. Although the system is not yet completed, and only one section of the city streets has been lighted by Hydro for three months, the work of construction is still going on. There are now 945 citizen customers, and the Commission announces that business justifies a reduction of ten per cent. in the rates, but this reduction will not go into effect until two law suits are settled.

Municipal

North Bay, Ont.—A by-law will be voted on by the ratepayers some time this month to raise $60,000 for road improvements during the year.

Toronto, Ont.—It has been definitely decided to build an incinerator on the site east of the river Don near Gerrard street.

Renfrew, Ont.—The town is raising $16,000 for the purpose of installing an electric lighting system. A by-law has been passed.

Belleville, Ont.—City engineer Evans has presented a report to the council in reference to the proposed filtration basin on Zwick's island. The cost is estimated at $14,485 and includes among other items, 830 feet of 24-in. cast iron pipe and a 24-in. gate valve.

Kingston, Ont.—The City Council has been notified by Nicholson & Elliott that they intend throwing up their garbage collection contract. The council will likely arrange for temporary collection while it considers the question of establishing a municipal incinerator.

Saskatoon, Sask.—The City Commissioners invite applications for the position of superintendent of the City's Municipal Street Railway. Applications containing particulars of previous experience, etc., will be received by Feb. 25, 1915.—F. E. Harrison, Mayor.

Thamesville, Ont. — A mass meeting was held here last Thursday evening to consider the installation of hydro. Reeve G. A. Fraser presiding. It was unanimously decided that the proposition was favorable, and would be submitted to the people at a later date.

Vernon, B.C.—The only large work contemplated this year is the erection of a new sewerage disposal plant and under-drainage system, which will be done under the local improvement plan and will cost from $90,000 to $105,000. This work is necessary because of a mandate of the provincial health authorities, who claim that the present disposal works contaminate Kalamalka Creek and Okanagan Lake.

Peterborough, Ont.—Arbitration proceedings began here on Jan. 26 to determine the price to be paid by the city under the Hydro system for the distribution plant of the Peterborough Light & Power Co., the city in the meantime having paid into court $100,000, the price placed on the plant by the Hydro-electric Commission. The company claims a much larger amount.

Medicine Hat, Alta.—By an almost unanimous vote the ratepayers have passed deficiency by-laws aggregating $155,000, and by almost as large a vote, voted small sums of money for improving the industrial sites, market and parks, paying for spur track laid to industrial site, and granting aid to the Agricultural Society. The extension of time for the C. N. R. to build into the city, and provision for its right-of-way were also passed.

Toronto, Ont.—The Toronto-Hamilton highway will not be the only work of its kind in the province when the Government good roads programme is carried into effect. Provincial Highway Engineer McLean returned last Saturday from Ottawa, where he has been canvassing the possibilities of an early start on the Ottawa-Prescott highway, extending some sixty miles from the capital to the boundary.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and Mr. F. W. Stobart, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Newmarket, Ont.—It has been decided to submit two measures to the electorate for ratification on February 22. One by-law authorizes the town to enter into a five-year contract with the Toronto and York Radial Railway Co. for a supply of 500 horse-power or more of energy The other by-law gives the council power to float an issue of debentures amounting to $15,000, for the purpose of purchasing and installing the transformers and other equipment necessary for the extension of the system.

Trade Gossip

Cobalt, Ont.—About 300 men have been laid off this week in the camp owing to the power shortage at the plants of the Northern Ontario Light & Power Co. The Coniagas mine and mill have practically been closed down and 125 men are idle at this plant alone. The Dominion Reduction mill has been shut down and the Caribou, Cobalt and Drummond Fraction are idle. The Crown Reserve has also laid off some men. About the same number of men will be out of work until about the middle of April, the mills shutting down in rotation.

Lessons on Oxy-Acetylene Welding and Cutting.—A second elementary winter course was started on Jan. 20 at the Montreal Technical School, 70 Sherbrooke street West, on the subject of Oxy-Acetylene Welding and Cutting Processes. Ten lessons will be given, one lesson every Wednesday evening from 7.30 to 9.30. An advanced course is also to be held every Friday, from 7.30 to 9.30, ten lessons in all. This began on Friday, Jan. 22, 1915. Theoretical lessons are being given by experts in both English and French, while the practical side will be taught in a fully equipped shop with individual benches.

Brantford Hydro-Electric—The first report of the Brantford Hydro-Electric Commission, as presented to the city council, shows a very satisfactory state of affairs, despite depressing conditions. A large sum was set aside for depreciation and then a net surplus of $2,000 was recorded. The earnings amounted to $35,496.54, and the total expenses $27,322.44, after including such items as interest on sinking fund, interest on debentures of $115,000. The gross surplus was $8,174.10, of which $6,000 was set aside for plant depreciation. This represents nine months' business, as the plant has only been installed completely for that length of time.

Toronto Harbor 1915 Expenditures—The Toronto Harbor Commissioners announced a few days ago that $2,100,000 was the amount estimated that will be be spent by them, and the Government on the harbor during the present year. The chief work contemplated will be the completion of another 5,000 feet of the sea wall to the east. The sea wall of 3,600 feet to the west has been finished except for the capping with concrete, which will be done early in the spring An additional wall to the east is planned and this will be brought to a similar stage of completion waiting for the the concrete capping in the spring of 1916. The approximate amount of dredging during the coming year will be 3,300,000 cubic yards.

Herman Boker & Co. Reorganize.—The firm of Herman Boker & Co. is now being conducted under the name of H. Boker & Co., Inc. The same line of

goods will be handled as heretofore, these consisting chiefly of Novo Superior high-speed steel, as well as other steels, and the various lines manufactured by Sir Joseph Jonas, Colver & Co., Sheffield, England. The new company is capitalized at $500,000, Carl F. Boker of New York being president, and Sir Joseph Jonas, of Sheffield, England, vice-president. F. E. Rejall continues as Canadian manager. Neither the old nor the new firm are German, nor are there German capital invested or Germans connected. Small tools such as reamers, milling cutters, taps, dies, etc., are made in Canada, while twist drills are made in both Canada and England.

Tenders

Ottawa, Ont.—Tenders were received up to February 3 for the supply of iron castings and posts.

Ottawa, Ont.—Tenders will be called shortly for lead pipe, cast iron pipe, and pig lead. Particulars may be obtained from the Purchasing Department, City Hall.

Toronto, Ont.—The Webb Lumber Co., 224 Van Horne Street, will sell their plant and machinery. Tenders to be in by February 8, and full particulars may be obtained from Rutherford Williamson, 86 Adelaide Street East.

Ottawa, Ont.—Tenders will be received until Monday, March 1, 1915, for the supply of best quality steam coal, to be delivered in quantities and at places mentioned on forms of tender. Forms of tender can be obtained at the Department of Public Works. R. C. Desrochers, secretary.

Ottawa, Ont—Tenders will be received by the secretary of the Board of Control, City Hall, Ottawa, up to Thursday, Feb. 18, 1915, for handrailing and lighting posts for Billings' bridge. Plans, specifications and full particulars may be obtained on opplication to F. C. Askwith, Acting City Engineer.

Ottawa, Ont.—Tenders for electric light wiring and fittings for the custom house, St. John, N.B., will be received until Tuesday, February 9, 1915. Plans, specification and form of contract can be obtained on application to the Department of Public Works, Ottawa, and at the office of D. H. Waterbury, Supt. Custom House, St. John, N.B.

Montreal, Que.—Tenders, addressed to the undersigned, will be received up to February 9, for steel bars, steel rails and angle bars, castings, sand, stone and ballast, Portland cement, steam coal, and run of mine smokeless coal. Copies of the specifications and tender forms may be obtained upon application to F. W. Cowie, chief engineer.

Toronto, Ont.—Tenders will be received, addressed to the chairman of the Board of Control, City Hall, up to Tuesday, March 2nd, 1915, for the construction and delivery of 24-in., 30-in. and 36-in. stop valves, and one 36-in. check valve. Specifications and tender forms may be obtained upon application at the office of the Water Main Extension Section, Department of Works, Room No. 9, City Hall.

Winnipeg, Man.—Tenders will be received up to Monday, February 15, 1915, for the removal of two through truss spans and for the manufacture, delivery and erection of two through trussed spans and alternatively for one through truss span and one through plate girder span over the Pinawa Channel. Instructions to bidders, plans, specifications and form of tender may be obtained at the office of the City Light and Power Department, 54 King street.

Saanich, B.C.—Tenders will be received by the undersigned at the Municipal Hall, Royal Oak, Saanich, B.C., up to March 12, for the supply of materials, including cast iron pipes and special castings, valves and hydrants. Specifications, schedules of quantities and particulars may be obtained from the municipal engineer's office, upon making a deposit of $25, which will be returned on receipt of bona fide tenders. Hector S. Cowper, clerk, Municipal Council.

Toronto, Ont.—The undersigned has been instructed to offer for sale the following:—

Parcel I.—The steamers "Meteor," "Temiskaming" and "Jubilee," with their equipment, the hull of the launch "Kiask," five scows, certain wharf properties, freight sheds and shipway at points on Lake Temiskaming and certain miscellaneous equipment, the whole being the property of the Temiskaming Navigation Company, Limited; and

Parcel II.—The steamer "Silverland" and her equipment, being the property of the Haileybury Navigation Company, Limited.

Tenders for the above will be received by the undersigned up to noon of Wednesday, the 10th March, 1915. James Hardy, assignee for benefit of creditors of Temiskaming Navigation Co., 15½ Toronto Street, Toronto, Ont.

Ottawa, Ont.—Tenders will be received up to February the 26th. for 1.000 sets of the undermentioned accoutrements, half quantity for delivery to H.M.C. Dock Yard, Halifax, and half to H.M.C. Dock Yard, Esquimalt, B.C.: Belts, waist (leather); bags, ammunition (leather); bandoliers (leather), braces (leather), water bottle slings (leather); holsters, pistol (leather); pouches, cartridge pistol (leather); mess tins and covers, canvas; haversack, canvas; water bottle, enamelware (with felt cover. Patterns may be seen, and tender forms with full information may be obtained on aplication to the undersigned and to the Naval Store Officers, H. M. C. Dockyards, Halifax, N.S., and Esquimalt, B.C. G. J. Desbarats, Deputy Minister of the Naval Service. Department of the Naval Service, Ottawa.

Personal

J. A. Baird, town engineer of Leamington, Ont., has resigned his position. J. J. Newman has taken over his duties.

William J. Phelan, late of the steamship firm of J. F. Phelan & Co., of Halifax, N.S., died there on January 15, aged 52.

J H. Laughton, of London, Ont., was elected president of the London and Middlesex Publicity Association at the annual meeting on January 22.

Howard Kelly, vice-president of the G. T. R., who was in Toronto recently, declared that the viaduct and esplanade work will go on in the spring.

Capt. James R. Innes, ex-commodore of the Michigan Central car ferry fleet, died at Walkerville, Ont., on January 25. Captain Innes was born in Chatham, Ont., 73 years ago.

G. G. Ulster, late of Fort William, Ont., has been placed in charge of the London, Eng., office, opened by the Canadian Car & Foundry Co., to look after foreign buisness.

C. E. McArthur, grinding expert, the Modern Tool Co., Erie, Pa., will spend several weeks in Canada. Mr. McArthur is making his headquarters at the office of the Rudal Belnap Co., Toronto.

R. G. Harvey, the city engineer, of Duncan, B.C., has handed in his resignation. Mr. Harvey has been with the city as city engineer, electrician, and waterworks superintendent almost since its incorporation, three years ago.

Charles B. Lester, for the past twenty years head of the sales department of the John McDougall Caledonian Ironworks, Ltd., Montreal, died suddenly at his residence in that city on January 25. Mr. Lester, by his genial personality, made many friends in the Canadian business world, and his loss will be keenly felt by those and his associates in the Caledonian Ironworks.

W. P. Hinton, assistant passenger traffic manager of the Grand Trunk System, and the G. T. P. Steamship Lines, has been elected to the presidency of

the International Water Lines Passenger Association.

H. H. Vaughan, assistant to the vice-president of the C. P. R., Montreal, Que., and Isaac Harter, Jr., superintendent of the Babcock & Wilcox Co., Bayonne, N.J., have been appointed members of the sub-committee to work with the boiler code committee of the American Society of Mechanical Engineers.

C. J. Coll, who for the past two years has been general manager of the Cape Breton Coal, Iron and Railway Co., with coal mines at Broughton, has severed his connection and leaves their service on April 15 to become a partner in the firm of Thompson & Adams, insurance brokers, of Halifax. Mr. Coll became general manager of the Acadia Coal Co., Stellarton, in 1900, leaving in 1912, and engaging with the Cape Breton Company in April, 1913.

Arthur T. Genest, one of the best known civil engineers in Quebec and Ontario, died on Jan. 27 at his residence in Ottawa. He was born at Fremont County of St. Maurice, Quebec, on July 10, 1859. Some of the works in these earlier days with which he was prominently identified, were the construction of the Laurentian Railway, and the Pontiac Pacific Junction Railway, now the Ottawa and Waltham. He was the first assistant engineer in the enlargement of the Lachine Canal between 1895 and 1897. He was first engineer for the Rapid Plat and Faran's Point Canal, the Balsam-Simcoe Lake division of the Trent Canal, and was engineer in charge of the final estimates for the completion of the Corwall Canal enlargement, 1901-04. Since 1904 the late Mr. Genest has been an engineer at headquarters for the projection of the Georgian Bay Ship Canal.

Catalogues

Anodes and Plating Salts are described in bulletin No. 600, issued by the Munning-Loeb Co., Matawan, N.J. The bulletin deals with anodes for plating processes, with special reference to the nickel anode and its principal features. Cast and rolled anodes made of other materials are also described. Other matter deals with salts and miscellaneous chemicals used in plating solutions. The bulletin is fully illustrated.

Cochrane Multiport Valves, a booklet of 72 pages just issued by the Harrison Safety Boiler Works, 3137 N. 17th St., Philadelphia, describes the multiport valves introduced by that concern for back pressure, relief and vacuum service, flow service in connection with mixed flow turbines, and check valve service with bleeder or extraction turbines. The essential idea of the multiport valves is the use of a number of small disks instead of one large disk, in order to secure greater safety, quietness, lightness of moving parts, and tightness. The several disks are each fitted with an independent dashpot held to seat by independent springs, the tension of all the springs being adjusted simultaneously by a pressure plate, the position of which can be changed by means of a hand wheel on the outside of the casing, thus there are no parts directly connected to the disks themselves extending through the casing, hence little possibility of binding, as by over-tightening of glands, or of tying down or overweighting, the movement of the pressure plate being definitely limited. Another advantage claimed is the ability to adjust the back pressure quickly and easily by changing the position of the pressure plate, which may be done from any distance as by means of chain or rods. For vacuum service, the construction is practically the same, except provision is made for water sealing. For flow service with mixed flow turbines, balance pistons are connected to the disks in such a way that the latter will not open except when the pressure in the exhaust steam pipe is greater than atmosphere. It is thus impossible, where one of these valves are used, for vacuum from the turbine to back up into the engine exhaust line through leaks of piston rod or valve stem packings. The multiport check valve is designed for use with extraction or bleeder turbines, to prevent reverse flow and consequent over-speeding of the turbine. In addition to full descriptive and tabular matter, the book contains numerous diagrams and layouts, also data on the effects of air in condensers and upon turbine performance.

Book Reviews

Syren and Shipping of date January 6, gives a remarkably complete synopsis of the happenings of 1914 as well as making a convincing analysis of the net results of the development of the shipbuilding and shipping business in all its phases during the same time. Every article is written by an expert in his branch. The war figures largely throughout the 156 pages of reading matter and 104 pages of solid advertising which make up this number, and its real effect on shipping, freights, insurance, coal and naval arrangements is demonstrated by highly illuminating statistics. It is a valuable number in every sense of the term.

Naval Recognition Book, by Fred. T. Jane, 73 pages, $7\frac{1}{4}$ in. x 5 in., with maps and illustrations. Published by Sampson Low, Marston & Co., London, Eng-

land. The secondary title of this book, "Silhouettes of British Fighting Ships," more clearly explains the style and purpose of publication, for it is by the silhouette or profile of a warship that it's class can be identified at sea. It may not be out of place to state that warships are built and designated in classes; the number in each class varies, of course, as do also the different classes of ships as regards some feature in design and arrangement of guns. This is the second edition, and the author is a recognized authority on naval matters. A book of this description, at such a time as this, is of more than ordinary interest, for although there are many who have not and may not have the opportunity of seeing any of the ships comprising the British Navy, the fortunes of each ship will be followed with interest during the present war. Silhouettes of war vessels in each class are given, together with the names, displacement, speed and armament. The Dreadnought classes take premier place, followed by all other types of war vessels, such as cruisers, torpedo boats, etc., down to depot ships. Several pages are devoted to silhouettes of British liners of 18 knots or over. The ships are classified according to the number of funnels and masts, while the speed and owner's name are given for each. Other matter includes several maps of important British naval bases, details of officers' uniforms, and specimens of British flags. The index, while rendering the usual service, incidentally consists of an alphabetical list of all the ships in the navy: an interesting feature in itself. This manual, although a cheap edition, will be of assistance to officers and men of all ranks in the navy or mercantile marine. It will also be of interest to the general public, especially at this time when the name of each ship should be known to everybody. A companion book to this and by the same author deals with the German navy in the same manner. Copies may be obtained for 40 cents, post free, from the publishers of Marine Engineering, 143-153 University Avenue, Toronto.

Classified Advertisements

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."
¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?
Rates (payable in advance) :—2c per word first insertion, 1c per word subsequent insertion, 5c additional each insertion when Box Number is required. Each figure counts as one word.
"CANADIAN MACHINERY" is the central market place of the machinery trades throughout Canada
¶ There is always some one looking for just such a proposition as you have to offer.

Manufacturers' Agent Wanted
to handle a line of plastic fire brick. Apply box 147. (7)

FOR IMMEDIATE SALE AT HALF COST—furniture factory equipment, either separately or complete. Large surface planer, turbine wheel, shafting, lathe and pulleys, good as new, and water power site. John Waddell, Orono, Ont.

SNAPS IN MACHINE TOOLS—ONE 24 INCH x 24 inch x 9 feet Iron Planer. One 30 inch x 30 inch x 8 feet Iron Planer. One 30 inch x 30 inch x 10 feet Iron Planer. The foregoing all of Bertram & Sons' make. One No. 2 Rockford Universal Milling Machine, including vertical attachment and extra cutters. This machine has only been used a few days and is guaranteed in perfect order. Canada Machinery Agency, 298 St. James Street, Montreal. (6)

POSITION WANTED.

A PRACTICAL AND PROGRESSIVE BRASS Foundry Foreman would like to hear from an up-to-date firm requiring the service of a reliable executive. Good metal mixer and can produce first-class castings at a minimum cost. Best references. Address Practical, Canadian Machinery. (5)

HINTS TO BUYERS

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For Cutting Bevel Gears the Gleason Gear Shapers are the best machines, both Theoretically and Practically. We use them exclusively.

Chicago Steel Bending Brakes

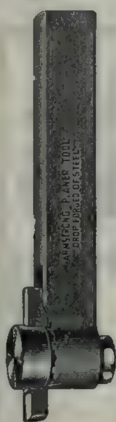
We are exclusive Manufacturers of Steel Bending Brakes, and our product shows it.

10 ft. for 10 Ga.

Only about three horsepower is required to operate this brake full capacity.

Catalog giving full description mailed upon request.

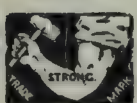
The Steel Bending Brake Works, Ltd., Chatham, Ontario



You can afford to use High-Speed Steel in

Armstrong Planer and Shaper Tools

They require no forging. Minimum of Grinding and Mighty Little Tool Steel. Our complete line is on exhibition in Block 41, Palace of Machinery, Panama-Pacific Exposition, San Francisco



Catalog sent for the asking.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

306 N. Francisco Ave., Chicago, U.S.A.

Genuine Armstrong Stocks and Dies

Hinged Pipe Vises.

Pipe Cutters. Steam and Gas Fitters' Tools.

Pipe Machines for Threading Pipe.

Either Hand or Power.

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328 KNOWLTON ST. BRIDGEPORT, CONN.

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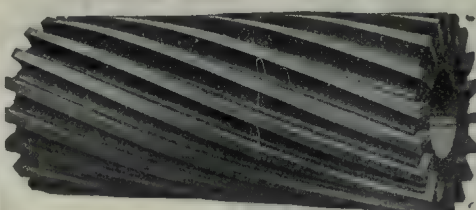
Taylor-Newbold Milling Cutters

Fast Cutting

Power-ful



Inserted Helical Blades of High-Speed Steel

FOR

Service—Utility—Strength—Power

4" DIAMETER FOR GENERAL USE

Write for Bulletin R. P.

THE TABOR MANUFACTURING COMPANY

PHILADELPHIA, PA., U.S.A.

¶ We know of a case recently where an advertiser received an inquiry from a small advertisement in

Canadian Machinery

¶ This inquiry resulted in an order, the profit on which will pay for the advertisement for two years.

New Machine Shop, Canadian Locomotive Works, Kingston

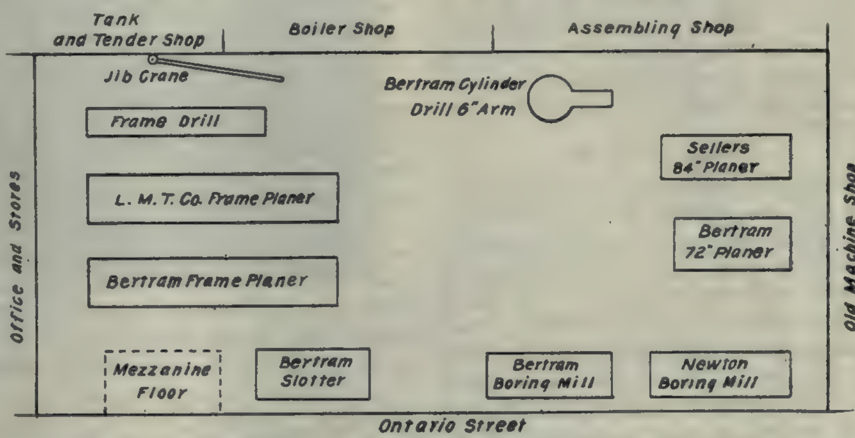
Staff Article

In our December 25, 1913 issue, we published a general article covering the rebuilding of the entire plant of this old-established concern and pointed out then that the work was being undertaken and carried through in departmental sections with a view to non-interference with the productive side of the plant as a whole. The present article deals with the recently completed new machine shop section, its tool and other equipment.

THROUGHOUT the past year, further enlargements to the plant of the Canadian Locomotive Works, Kingston Ont., have been completed, the most important of which is the new machine shop. This shop has been erected in accordance with the plans drawn up some time ago for the general extension and the re-building of the whole institution, and in this work the Company have been dealing with a difficult problem, the present site being somewhat cramped in area for the accommodation of a plant of the necessary size and capacity.

The site was first occupied by this firm in 1850. The location is ideal because of the fact that it is on the waterfront, thus ensuring raw materials being delivered by water at the company's piers which are only a few yards away from the works. Electric travelling cranes from the works are carried on their runways right out on these piers, making the handling of materials transported by water simplicity itself.

With regard to rail connections, the firm is also well situated. The Canadian Pacific, Grand Trunk and Canadian Northern railroads all enter the city of Kingston and a spur line from the works connects with each road. Further, the city has grown all around the present location and the works are now within a few minutes walk of the centre of the business district and only a short distance from the residential portion of the city. Kingston also provides a goodly number of homes for the employees of such an institution.



NEW MACHINE SHOP LAYOUT, KINGSTON LOCOMOTIVE WORKS.

Thus the numerous advantages offered by the old site more than compensate for the disadvantage of the cramped conditions, especially so because the new plant has been so completely designed that this disadvantage has been largely overcome. Great credit must be given to those responsible for the general layout of the buildings, forming, as they do, the most compact locomotive shops on this continent. The recent extensions, as they exist at present, are complete in themselves, but the complete plans have not yet been executed. The prevailing industrial depression has caused such a slackening in trade conditions that it has been found that the shop, as it now stands, is quite capable of handling all work meanwhile available.

FIG. 1 EXTERIOR VIEW OF MACHINE SHOP ADDITION.

Machine Shop Location and Surroundings.

As already stated, the new machine shop is one of the latest additions to the plant. It is, roughly speaking, 190 feet long by 76 feet wide. The framework of the building is steel with brick walls, all being built on a concrete foundation. The southern side of the shop consists merely of a row of steel columns, between which there is free access into the erecting shop, the boiler shop and the tank and tender shop. The wall of the new shop extends above those of the old shops and consists almost entirely of glass. The western end of the shop is bounded by the wall of the old machine shop. There are several large arches cut through this wall giving free communication to the old shop, where there are still being executed many machine operations on the smaller parts. Many of the larger and heavier machine tools have, however, been removed and placed in the new shop, while the remaining tools in the old shop have been rearranged with the idea of increasing the production on the smaller parts.

The north wall is of brick and faces on Ontario street. This is the long dimension of the shop. Large windows and ventilators are found in this wall which add greatly to the good lighting facilities of the plant. The east wall is provided for by the west end of the office, which building adjoins the shop, but this is only a temporary arrangement because the plans for extension provide for a new office building to the east of the present offices. In fact, the foundations for this new office building have been laid. The new shop will then be extended to cover the ground at present occupied by the offices. In the new shop all the tools for the heavy machine work on the locomotive frames, cylinders and drive-wheels are installed. The floor is of mastic asphalt, except in that portion of the floor opposite the erecting room, where a considerable area of creosoted wooden blocks are laid.

Lighting Facilities.

A wide skylight extends for practically the whole length of the new building, while the roof and monitor are largely of glass, providing an excellent system of natural lighting. The artificial lighting is also very efficient. Two varieties of lights are used, these being the Cooper-Hewitt mercury vapor lamp and the nitrogen incandescent lamp. Both types are fitted with suitable reflectors and when in operation make the shop practically as light as day. The lamps are all suspended from the roof trusses above the crane runways.

All the steel work in the shop, as well as the window frames and cranes are painted a light yellow. The machine tools are all painted grey, and the end walls of stone are all white-washed. Having the interior walls and the contents of the building al painted a light color assists very materially in the distribution of the light.

Crane Service.

A 10-ton Whiting crane travels over the entire shop. This crane is electrically operated, with runway high up in the eaves. In the erecting shop a 20-ton crane is located. The runway is at right angles to the runway of the 10-ton crane in the new shop, and this runway of the 20-ton crane is continued into the new shop for a sufficient distance to allow the latter to run directly under the 10-ton crane in the new shop. Thus, material can be transferred from one crane to another and be transported from one shop to another with the greatest of ease. This feature has greatly increased the general efficiency, especially as the large pieces are all machined in this shop and direct transportation to the erecting shop is assured. Near a large multiple spindle drill press in the south-east corner of the shop, is a 6-ton steel jib crane manufactured by the Northern Engineering Works, Detroit, Mich. From the foregoing it will be noted that the facilities for handling the heavy pieces are excellent.

Machine Tool Equipment.

In the south-west corner of the shop is placed an 84-inch planer used for finishing cylinders. The machine was furnished by Wm. Sellers & Co. of Philadelphia, Pa. Pieces up to 84 inches square can be machined in this planer which is motor driven by a 35 h.p. variable speed Westinghouse motor. The mechanical application of the power to the table is through the medium of a worm and rack, while the reversing operation is accomplished through an air-clutch. The planer is in every sense a strictly high-class machine. The drive is of particular interest and is giving entire satisfaction. The lowering and hoisting of the cross-head is accomplished through a belt-driven mechanism from the motor.

Beside this planer is another planer, also used in machining cylinders, which was supplied by the John Bertram & Sons Co., of Dundas, Ontario. This planer can handle pieces up to 72 in. square, and is also electrically driven. The motor, manufactured by the Triumph Electric Co. of Cincinnati, Ohio, is of 30 h.p. and of variable speed type. The reversing operation is accomplished through the reversing of the motor. The switchboard, rheostats, starting apparatus and reversing switches were all furnished by the Rudel-Belnap Machinery Co. of Montreal. A small 2 h.p. motor is placed on the standard frame to supply the power used to hoist and lower the cross-head.

In the north-west corner of the shop is placed a Newton boring mill. This machine is driven by a 13 h.p. Westinghouse motor of the variable speed type, and the table is raised and lowered on large screws which are mounted on ball thrust bearings. A 3 h.p. variable speed motor is used to operate these screws. All the motor control switches are enclosed, and guards protect the commutators and armatures of the motors; thus all oil and dirt is prevented from reaching these portions of the machines.

Directly east of this machine is a Bertram boring mill, which is driven by a 10 h.p. variable speed Westinghouse motor. A very ingenious control, furnished by the Electric Control & Mfg. Co., of Cleveland, Ohio, is installed on this machine, on which all the heavy boring of cylinders, bushes, etc., is done, together with the Newton boring mill next to it. The machines are of very massive in construction and do extremely accurate work. Still further to the east is a machine for slotting locomotive frames. This latter machine was also supplied by the John Bertram & Sons Co., Dundas, Ont.. It is driven by a 20 h.p. variable speed Westinghouse motor. The controlling apparatus was also supplied by the Westinghouse Company.

FIG. 2. INTERIOR VIEW OF MACHINE SHOP ADDITION, LOOKING FROM SOUTH-EAST CORNER.
Frame Planers and Frame Drill Press in Foreground. Note also Crane Runway from Erecting Shop entering New Machine Shop at Left of Photo. Heating Ducts are shown along North Wall.

In the eastern end of the new shops are two frame planers of special interest. They are both fitted with an electric system supplied by the Lancashire Dynamo & Motor Co. of Toronto, and their drive is perhaps more efficient and has a larger range of adjustments than any other planer drive manufac-

tured. The first of these two planers was built by the John Bertram & Sons Co., Dundas, Ont., and was designed especially for the planing of locomotive frames. Between the standards, pieces up to 72 in. in width can be handled, while, under the cross-head, about 18 in. to 20 in. is the limit in height that can be machined. The nominal rating of the machine which drives the planer is 50 h.p. and the motor is of the direct current variable speed type.

FIG. 3. INTERIOR VIEW OF MACHINE SHOP FROM NORTH-WEST CORNER. Frame Planer and Frame Drill Press in the far Corner. Note Jib Crane near the Drill Press, also 20-ton Cleveland Crane Runway extending into New Machine Shop under Whiting 10-ton Crane Runway.

This system makes use of a motor-generator set taking the local supply of curent and applying it to a motor which has been designed to suit the available voltage and kind of current. This motor forms the motor end of the motor-generator set, while the generator end of the set supplies the current to the motor which is connected to the driving end of the machine. Any cutting speed can be obtained from about 20 feet per minute to 90 feet per minute.

The return speed is also capable of wide adjustment. Under ordinary working conditions, however, the maximum speed of 90 feet per minute is maintained, but should it be found necessary to machine a particularly heavy piece, practice has shown that it is best to reduce the speed of the return stroke. The great shock given the driving gears and the rack at the end of the cutting stroke is quite apt to break these parts, when the return speed is excessive, with a heavy casting on the machine.

Among the many adjustments is one that allows the tool to enter a cut slowly, then the speed is increased as the tool passes on to the solid part of the cut. This is very useful in breaking cast iron scale when making a roughing cut. The edge of the tool is thus preserved and is able to accomplish a greater amount of work without being reground. Another adjustment is one whereby the tool can be accelerated when cutting air on the cutting stroke, and again slowed down when the tool is about to re-enter metal. One particularly interesting feature of the drive is that when the planer is reversing there are really no signs of a high peak load. The armature of the motor which reverses is so designed that it tends to feed back to the line through the motor-generator set at the time of the reversal, and in this way the tendency toward a peak load is absorbed.

The second planer equipped with this drive is one that was supplied by the London Machine Tool Co., of Hamilton, Ont. An 80 h.p. Lancashire Dynamo & Motor Co. set drives this planer, which has an exceptionally long table but in other respects it is of standard design. It is used almost exclusively for planing locomotive frames. Between the standards and under the cross-head a casting 72 in. square can pass. A small motor on the frame supplies power for raising and lowering the cross-head.

To the south of these two planers is a frame drill press of the multiple spindle type. This machine is driven by a 20 h.p. variable speed Westinghouse motor, and was manufactured by the John Bertram & Sons Co., Dundas, Ont. In the south-western corner of the shop near the cylinder planers is a cylinder drill press with a 6-ft. radial arm. This drill-press was supplied by John Bertram & Sons, and is driven by an 8 h.p. variable speed Westinghouse motor.

The foregoing completes the number of machine tools located in the new shop at present. All are placed on concrete foundations and two additional foundations have been prepared, one for a new frame drill press, and the other for a new cylinder planer. Nevertheless, with the present equipment the capacity of the works has been greatly increased.

The electric energy consumed in the plant is all generated in the company's power house. All power circuits are of 220 volts and are direct current. Each machine tool has its own individual motor drive.

FIG. 4. LOOKING FROM NEW MACHINE SHOP INTO ERECTING SHOP.

Heating and Ventilation.

The heating is accomplished through a

system of steam coils located in a small chamber on a mezzanine floor in the north-east corner of the shop. A Sturtevant fan driven by a 20 h.p. Sturtevant motor draws air through the coils and delivers it to all parts of the shop through a system of large galvanized iron pipes. These pipes, at all delivery points, are fitted with regulators and controls. The efficient ventilating system is ably assisted in the warmer seasons by a large number of ventilators in the sidewalls and the monitor.

Summary.

With this latest extension, this very progressive institution is in possession of a thoroughly up-to-date plant, and the new management, which upon assuming control of the plant a few years ago, began immediately to lay plans to modernize the plant and equipment, are to be congratulated upon their success, for nowhere now in Canada can the facilities for designing and constructing locomotives be surpassed. Undoubtedly a bright future is in store for this plant when Canadian railway transportation gets back to normal again.

GASOLINE ENGINE FACTORY LAY-OUT

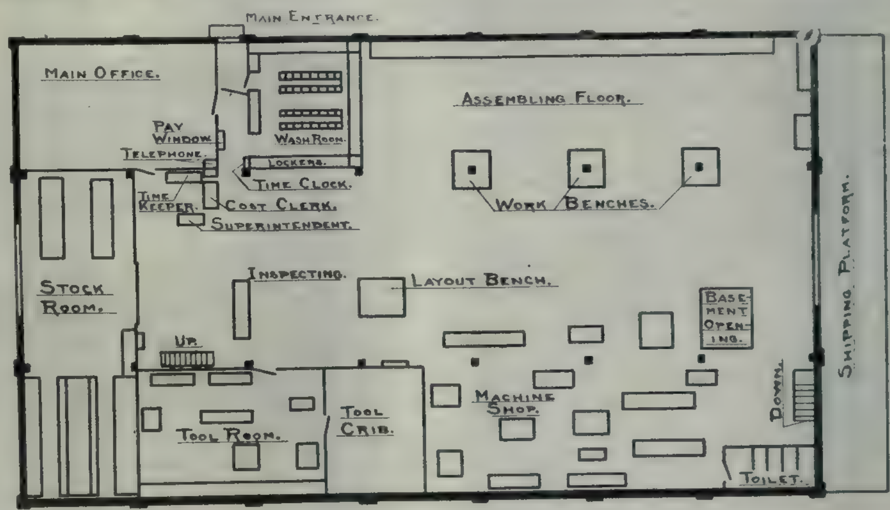
By D. O. Barrett.

THE accompanying floor plan of a gasoline engine factory shows the result of several changes which were made to determine the most convenient and economical method of handling that class of work. This particular plant operated a complete and quite elaborate cost system, which in the first instance was handled from the office, the location of the latter being one corner of the building, with the main entrance at the side. The wash room was also located at the front entrance, together with the lockers for the workmen. In the morning the door A was locked, and B was left open. This caused all employees to pass first through the wash room and then past the time clock in order to get into the factory proper; the idea was for each employee to be in his working clothes and ready to start work before punching the clock.

Due to numerous misunderstandings because of the fact that the men handling the system in the office did not appreciate the conditions in the factory, the entire purchasing, stock keeping, and cost departments were placed directly under the superintendent; the desks of the superintendent, cost clerk and time keeper being shown just outside of the main office. The cost clerk took care of all the purchasing, handling the stock records and all the details of the cost system, and a window was cut in the corner of the main office so that the telephone would be handy either from the factory or office side.

The drafting room had originally been across the street in another building, under the supervision of a chief engineer working directly under the general manager: This arrangement did not, however, work out very satisfactorily, and the drafting room was then placed under the supervision of the superintendent, being moved into the main building, directly over the stock room in the main bay, the stairs shown marked 'up' leading to same. The drafting room was built with glass along the entire side, so that it was possible for anyone in the drafting room to see just what was going on in the factory as well as to notice any shipments, the shipping platform being located at the other end of the building.

The pattern shop was across the street, and a series telephone was provided there also in the superintendent's office and drafting room. This gave the superintendent communication with these two departments without any outside interference. The factory originally had about ten of these series telephones, but the multiplicity of calls was very annoying, resulting in extremely poor service, and eventually the system was abandoned. It was then cut up into two distinct parts, the first of which has just been mentioned and the other comprised the general manager's office, stockroom, basement stockroom and superintendent's desk. This rearrangement of the phone system worked out very nicely and proved to be much more convenient and serviceable than the old method.



GASOLINE ENGINE FACTORY LAYOUT.

The shop time cards, after being collected and sorted by the time-keeper were passed to the cost clerk who arranged them in their proper envelopes, each of which was numbered for its corresponding job in the shop. As soon as a job was completed and the time and material recapitulated on the envelope, same was passed to the office where the proper entry was made in finished stock. All castings were purchased outside and the majority of these were stored in the basement and brought to the machine shop through the basement opening by means of an electric crane which travelled the entire length of the shop.

Having the cost clerk and timekeeper located directly in the factory made it possible to easily keep track of each job passing through and it was also possible to readily locate and determine any error almost as soon as it occurred. All the foremen had ready access to both the superintendent and cost clerk, and any difficulties were reported immediately in person to the proper authority.

The work benches on the assembling floor were placed around the building columns with a vise at either side, each bench accommodating two workmen. As the engines were assembled, they were set into the main bay and then taken to the basement for testing. The entire layout worked very satisfactorily and made it possible for those in charge to look after their respective duties with a minimum of effort.

Portable Power Hammer.—A new electro-pneumatic hand hammer, designed especially for riveting and cutting in machine shops and drilling in stone quarries, claims the advantage of portability over the ordinary compressed air hammer, as it can be attached to any lighting or power circuit. A small motor-driven air compressor operated at low pressure is connected to the hammer by a length of armored hose, and rapid admission and withdrawal of air behind the hammer-head piston gives the blows of the hammer. The strength of the blows is adjustable. The complete apparatus is transported to the place desired on a light truck, and an eye bolt on the air-pump provides for suspension at any height that may be necessary.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

MACHINING BRAKE SEGMENTS.

By W. G.

THE accompanying drawings illustrate a simple method of machining semi-circular brake segments of rather delicate design. It was very essential that they should be accurately machined, otherwise, their efficiency as working units would be considerably impaired, and further, the quantity required was insufficient to warrant the outlay of a more expensive set of tools, thus the question of first cost had to be seriously considered. A glance at the drawings will, no doubt, give a clear idea of their general construction and operation.

Fig. 1 is a front and side view of the turning fixture for operation 1, part A being the holder. This consists of a cast iron face plate having steps or projections A_1 and A_2, the latter being utilized for locating the work. It will be noticed that the projection A_1 stands slightly clear of the work, the object being to provide clearance for the turning tool. Parts B, C and D are the stud clamping plate and nut respectively. The whole turning and facing operation is performed at two settings, the first being machining the top and one face and the second consisting of finishing off the opposite face. This completes the turning and facing operations.

Fig. 2 is part sectional elevation and plan of drill jig for the second operation. The jig body E consists of a mild steel plate having formed in its underside a locating recess E_1, the object of the latter being to centralize the jig as shown. Parts F and G are the positioning pegs. These are made from silver steel and should be carefully located in the jig body. It is also very essential that they should be made a good tight fit for the holes in the jig body E. The drill bushes H and I are made from best cast steel and are hardened and ground.

With reference to the locating recess E_1, it will be seen that the outer side only (largest diameter) is intended to fit the work, the inner side being clearance.

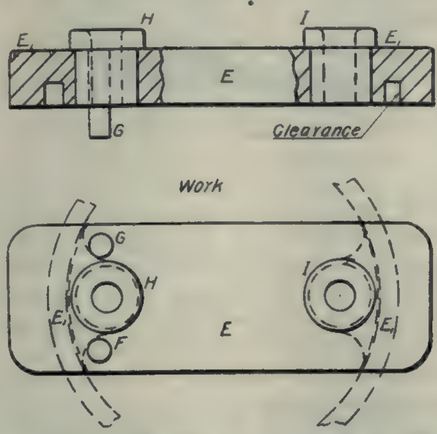


FIG. 2. PART SECTIONAL ELEVATION AND PLAN OF DRILL JIG FOR SECOND OPERATION.

The third operation is performed by an ordinary pin drill or counterboring tool and consists of facing off the lugs. This part of the work is thus machined on its own base which insures the lug faces being true.

The fourth and last operation consists of parting the segments after the completion of the turning and drilling work. The slitting fixture for this is shown in Fig. 3. Part K the base is made from a rectangular cast iron slab and is provided with two central locating pegs L and M. These are made of mild steel and should be case-hardened and ground, care being taken to see that they are a free sliding fit (not loose) for the holes in the work.

Part N is the clamp plate which is made from a piece of flat mild steel bent over at the one end as shown. Parts O and P are the clamping stud and nut respectively. Part R is the supporting spring for the clamp plate, its object being to prevent the said plate from falling when clear of the work.

The sequence of operations is as follows: The work is first dropped into position on the pins L and M and the clamp strap N is slid forward over the work and secured in position by means of the nut as shown. After the one side of the segment has been cut through, it is reversed and the same operation applied to the other side, thus entirely completing the machining.

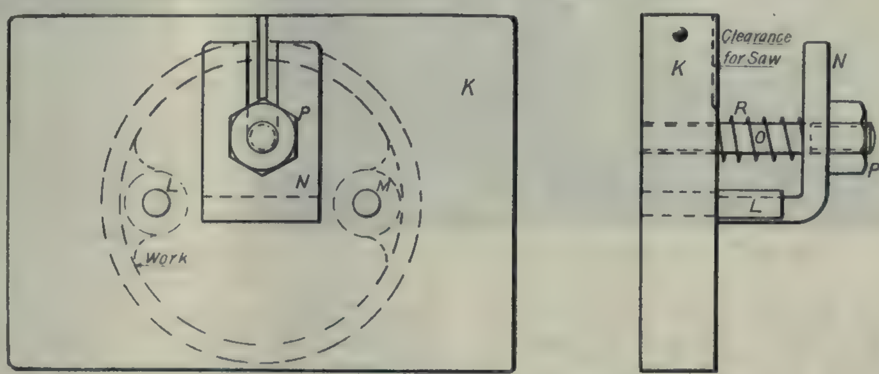


FIG. 3. SLOTTING FIXTURE FOR FOURTH AND LAST OPERATION.

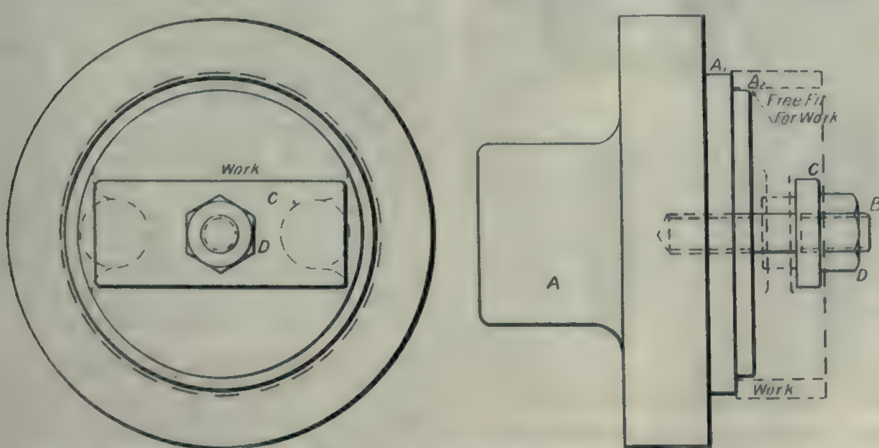


FIG. 1. FRONT AND SIDE VIEW OF TURNING FIXTURE FOR FIRST OPERATION

DEVICES FOR FINISHING SPHERICAL SURFACES.

By Avery E. Granville.

THE devices and machine attachments for the finishing of spherical surfaces are almost innumerable, for nearly every shop doing any range of work has to meet the question at some time or other. Oftentimes a formed tool will solve the problem, but many times the nature of the work prevents. One great trouble with most formed tools

used for this kind of work is that the cut is too great and has a tendency to chatter at a critical time. However, where the surface does not have to be a true curve, or where only commercial accuracy is required, a formed tool is often the best thing to use. It is not the intention here, however, to describe or show any of the various types of formed tools that might be used, but only devices a little out of the usual run, that have been made in shops in different parts of the country.

Turning the End of a Ball Lever.

The first example shown in Fig. 1, is the turning of a ball lever. This lathe attachment is in use in the shop of a prominent automobile maker. The lever is a forging, which is chucked between formed false chuck jaws, as shown. The turning device is bolted to the cross-slide of the lathe in place of the usual tool-block. The turning tool A, is carried in a revolving block set into the holder B. A slide in the face of the block, which is adjusted by means of the screw C, makes it easy to set the cutting tool as needed. The tool block is revolved by turning the ball crank D, which turns a worm meshing with a worm-gear at the back of the block. This device turns a perfect ball, and gives a well finished surface.

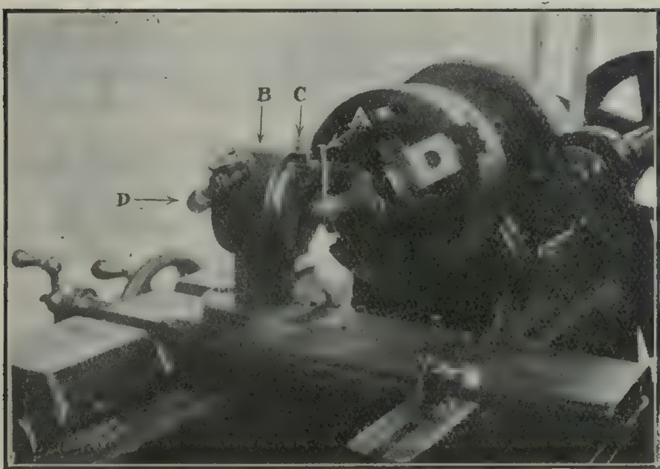


FIG. 1. A BALL LEVER TURNING DEVICE.

In direct contrast to this device is a tool used by another firm in exactly the same line of business. This tool is shown in Fig. 2, and consists simply of a hollow, cylinder, hinged to a suitable shank. The notch A is cut in it to admit the neck B of the lever that is turned. The lever is chucked as shown in the first example, and the tool is placed in an ordinary tool post and fed straight in. The face of the cylinder is slightly beveled away from the inner edge, so as to form a sort of scraper. The amount of metal removed is not great, and the result is all that the company requires for this class of work.

Grinding a Ball.

The balls used in ball and socket joints as a rule have to be pretty accurately finished. A big engine building company grinds theirs on a grinder fitted as shown in Fig. 3. The ball and shank are centered and turned to approximate size. A collar A is then clamped on and the piece mounted between centers as shown. The centers are mounted on a long table which is swiveled on a pin exactly under the center of the ball to be ground. As the work is turned by the belt B, running in the attached collar or pulley, the operator swings the table slowly around and feeds in the wheel C in the ordinary way. A fitted ball and socket are shown at D. Threads are cut on the shank after the ball is ground. This is done in a lathe, using the type of dog shown in Fig. 4. The ball is clamped between the cups E and F, with the tail G outward. The socket parts are bored out with the type of tool shown at H.

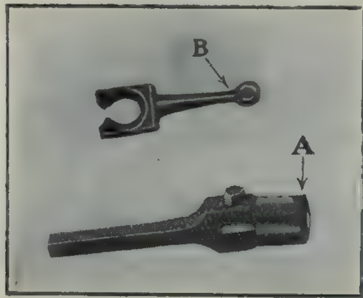


FIG. 2. BALL-TURNING TOOL

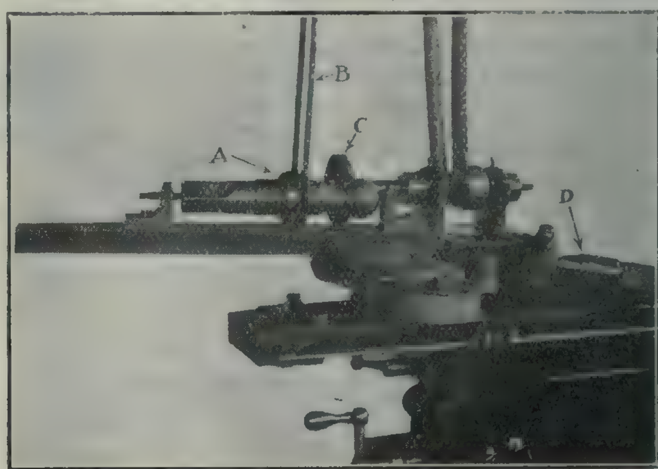


FIG. 3. GRINDING A BALL.

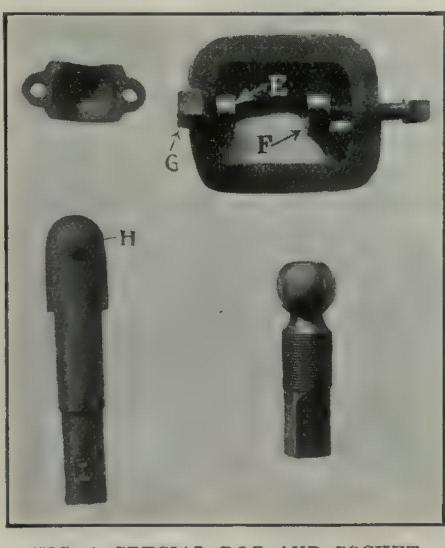


FIG. 4. SPECIAL DOG AND SOCKET BORING TOOL.

Ottawa Machinists.—What proved to be a very interesting meeting of the local machinists was held on Jan. 20. There was a large attendance, and through the presence of a grand lodge officer, in the person of Vice-President McLelland, much valuable information was gained by the members, who were pleased to learn that the industrial outlook in relation to the craft was brighter than for some time past. The interesting feature of the evening was the election of office bearers. This event was a few weeks behind scheduled time, owing to some of the old officers being given time to reconsider their attitude in declining nomination. After a spirited and keenly contested election the following were elected:—President, L. M. Landsky; vice-president, W. Riddel; financial secretary, A. Fulton; recording secretary, J. Burnie; treasurer, R. Steel; conductor, G. Sweet; sentinel, M. Paynter; auditors, Messrs. Gillespie, Carson, Barrett; trustee, J. Teange. After election the new officers invited the members to participate in a social evening to be held at the next regular meeting. This will also take the form of a joint installation with the officers of Local 412.

The Algoma Steel Corporation of Sault Ste. Marie, Ont., has opened an office in the McGill Building, Montreal, in charge of G. A. Irwin.

THE ROMANCE OF COPPER.

If there is one metal in the world upon which general attention is riveted it is—next, of course, to gold—copper. Its increasing necessity to industrial development and its comparatively restricted occurrence have long rendered it a metal which came peculiarly within the scope of the financial operator, and now, when the law of supply and demand was regulating itself on lines of economic stability, and copper was becoming less of a speculative medium and more of a prosaic commodity of ordinary commerce, there comes the war to emphasize at once its special utilities, and at the same time its unequal geographical distribution.

Copper in Early Weapons.

Time was when Britain ruled the world of copper as she rules the seas. The weapons and the armour which the ancient Greeks and Trojans used in their sanguinary combats were of copper, and as likely as not British copper at that. The Roman warrior or his craftsmen contemporaries knew a little more than Homer's heroes, for his sword was made of the alloy bronze, really a mixture of copper and tin, such as later was made into another type of death-dealing instrument and styled gun metal. The average Roman sword blade consisted of 91.4 per cent. of copper, and the remainder tin; while the English 8-pounder cannon in vogue before the wired steel gun came into existence contained 91.66 per cent. of copper and the balance tin. When man discovered how to work iron, copper had less "military significance," but it was again pressed into service as bronze or gun metal when the Chinese (or Roger Bacon) or some other benefactor of the human race found out the slaughtering properties of a certain explosive powder. In the meantime copper had been largely used for more peaceful purposes, and so it has been throughout the history of civilization.

Copper Smelting in Britain.

Copper is the metal which has been prominently identified with the arts of peace—and war. Somewhere round the year 1500, perhaps earlier, smelting works were established at Neath, and a hundred years or so later the smelting industry was firmly seated at Swansea. There were also smelting works in Staffordshire and Lancashire, but Swansea easily led the way, just as the Cornish mines did among the supply sources. At the commencement of the nineteenth century the output of refined copper from the Cornish mines was close upon 5,000 tons, Anglesea ores being responsible for another 2,000 tons. This 7,000 tons constituted 75 per cent. of the world's output, yet a hundred years later the same mines only produced the almost negligible quantity of 550 tons. In the interim the smelters of Swansea quite realized what the discoveries of easily procured copper abroad meant, and they imported vast quantities, so that from 1850 to 1860 the Associated Copper Smelters of Swansea enjoyed a monopoly.

Copper Smelting Abroad.

Such a condition of things, however, could not long continue. New sources of supply were rapidly being exploited. In 1830 Chile was sending large consignments of copper ore to South Wales, and in 1842, in order to achieve a more liberal profit than that allowed by the monopoly, the Chilians commenced to smelt for themselves, with the aid of expert workers from South Wales. The same year saw the Kapunda and Burra Burra mines opened, and in 1844 the copper resources of the Lake Superior area were exploited. In fact, copper was systematically searched for the world over, and side by side with this extensive development of the supply field there were new processes for the recovery of copper from waste ores, with the result that the refuse of earlier workings was made to yield a rich harvest, and mines which had long been shut down were reopened.

The Speculative Feature.

Naturally, the exploitation of new sources of supply and the failure of old have contributed not a little to foster the speculative spirit in copper trading. The Swansea smelters managed to ensure high prices in the 'fifties, and the Secretan Syndicate in 1887-9 aimed at absolute control of the copper supply, and actually controlled 85 per cent. of the world's output. Such a corner as this necessitated a huge expenditure, the Comptoir d'Escompte loaning the syndicate over six millions sterling. Copper went up from 11 cents to 18 in a month. Fortunately, there was one source of supply which the Syndicate had overlooked, and as prices rose arbitrarily consumers refused to buy and preferred to wait until the old copper and bronze, etc. collected from heterogeneous sources, was re-smelted. The quantity of copper forthcoming from this scrap was such that the Syndicate had to climb down. From over £100 per ton, copper had dropped to £70, and then it fell to £35 in a single day ; the corner collapsed ; and, of course, the Syndicate had to face financial ruin. Another effort at controlling the world's copper—that of the Amalgamated Copper Company, of the United States—was also unsuccessful.

World's Annual Supply

The world's annual supply of copper is now over one million tons, of which the United States produces over 600,000 tons. Mexico is responsible for about 75,000 tons ; Japan and Spain and Portugal produce about 60,000 tons; Australasia about 50,000 tons; Chile, 40,000 tons; Canada and Russia, about 35,000 tons; Peru, about 30,000 tons; and Tanganyika, whose deposits are said to be both rich and extensive, 20,000 tons. With the exception of Spain and Portugal the copper requirements of European countries have to be made up by importation. If there is an exception, it is Norway, whose mines produce about 12,000 tons. Italy produces 2,500 tons, and Austria about double that amount. Germany's output, however, is about 25,000 tons, which is probably one-eighth of the quantity she consumes. Austria's annual consumption in normal times is about 35,000 tons.

Requirements Arising From the War.

What the requirements of these countries are now it is impossible to say, but they must be enormously greater. No copper means no bronze, no brass, no gunmetal, and hence no material for the scores of purposes for which it is used in war material, whether ashore or afloat; and over and above this,, no copper means a very serious restriction of the manufacture of electrical appliances for field telegraphs and field telephones, appliances for which copper is a prime necessity. Copper is thus to a great extent vital to a nation conducting a latter-day war, and hence the whole civilized world is interested in the question of whether or not Germany will be enabled to replenish her supplies. Of course, the position of the United States is quite intelligible. They are business people and they produce somewhere in the neighborhood of 60 per cent. of the world's output. They are desirous of doing business as usual, and perhaps naturally, do not wish to understand why, because two nations are at war, one should prevent the other receiving United States copper. In this connection it is certainly significant that, while Germany should receive 140 million pounds of copper from the United States, Holland, which is hardly a manufacturing country, should have received over 200 million pounds of American copper in the same year. The propinquity of Rotterdam to the Rhine instantly suggests itself, as also does the fact that Italy is neighbor to Austria. The copper trade of neutrals with easy access to Germany has increased enormously. The ultimate destination of their abnormal importations is obvious, and English statesmanship will be failing in its duty to civilization if it allows the common enemy of humanity to receive ad lib so prime a necessity to the prosecution of his unjust war.—Syren and Shipping.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

RIVETED JOINTS.—II.

THE joints commonly used for longitudinal seams in boiler work are the double-riveted and triple-riveted butt-joints with double cover plates. Quadruple-riveted joints are also used to a considerable extent for high-pressure work and large boilers. It is easily seen that a more efficient joint means that the thickness of the plate can be reduced, and in a large boiler this saving may easily pay for an extra row of rivets.

The inside cover plate may be made wide enough to take in all the rivets, while the outside plate is made narrower so as to miss the outside row of rivets. Lap joints are used only on girth seams for good work, as they become weakened by continual use. This weakening is caused by the twisting and bending effect of the lap joints when under strain and its subsequent return to the original shape when the strain is removed. The best spacing for different types of riveting can be found for all thicknesses of plate in the various mechanics' handbooks. For double-riveted joints it is customary to locate the first row at very nearly the minimum spacing and the second row at double this spacing, the rivets of the second row coming opposite the spaces in the first row. In triple riveting the front two rows are usually spaced alike, but further apart than the front row of the double-riveted joint, the rivets of the third row being spaced at twice the distance. The spacing of the outer row of rivets must not be too great to allow of properly calking the joint.

* * *

Question.—A riveted joint is made up of 1 inch plates, two cover plates and a single row of $1\frac{1}{4}$-inch rivets spaced at 3 inches. How close to the edge of the plate could the rivet line be placed so that the shearing strength of the plate would still be as great as the shearing strength of the rivet?

Answer.—The shearing area of the rivet $= 1.25 \times 1.25 \times .7854 \times 2 = 2.454$ sq. in.

The shearing area of the plate per inch is 2 sq. in. The length required then is $\frac{2.454}{2} = 1.227$ inch, or the rivet line would have to be approximately $1\frac{1}{4}$ inch from the edge. The custom of placing the rivet line $1\frac{1}{4}$ diameters from the edge of the plate, therefore, gives ample strength.

Question.—In a single riveted butt joint with a single cover plate, 1-inch plate and $1\frac{3}{8}$-inch rivets, what should be the spacing in order that the tensile strength of the plate be equal to the shearing strength of the rivets?

Answer.—The pitch of the rivets less the diameter of the rivet hole multiplied by the tensile strength of the plate must equal the shearing strength of the rivet, or $P—1\ 7\text{-}16 \times 54{,}000 = 1.4849 \times 50{,}000$;

or $P—1\ 7\text{-}16 = \dfrac{1.4849 \times 50{,}000}{54{,}000} = 1.374$

inches; or Pitch $= 1.374 + 1.4375 = 2{,}8115$ inches, or approximately 2 13-16 inches.

* * *

Question.—In a 60-inch boiler carrying 75 pounds pressure, and for which $\frac{3}{4}$ rivets are used, what should be the rivet spacing for the girth seams using a safety factor of 6?

Answer.—The total pressure tending to separate the boiler endways is $60 \times 60 \times .7854 \times 75$. Shearing strength of one rivet $= .4418 \times 50{,}000$. Number of rivets required $= \dfrac{60 \times 60 \times .7854 \times 75 \times 6}{.4418 \times 50{,}000}$

$= 59$ approximately. Circumference $= 60 \times 3.1416 = 157.08$. Spacing $= \dfrac{157.08}{59}$

$= 2.66$ inches, or, say, $2\frac{1}{2}$ inches.

* * *

Question.—Considering that the whole strength of a diagonal stay tends to shear off the rivets at the end, how many $\frac{3}{4}$ rivets would be required for a stay, the weakest part of which is $1\frac{1}{4}$ inches in diameter.

Answer.—The tensile strength of the bar is $1\frac{1}{4} \times 1\frac{1}{4} \times .7854 \times 54{,}000 = 66{,}269$ pounds.

The shearing strength of a $\frac{3}{4}$ rivet $= .4418 \times 50{,}000 = 22{,}090$ pounds.

The number of rivets required is $\dfrac{66{,}269}{22{,}090}$

$= 3$ very nearly.

* * *

Question.—Design the riveting for the longitudinal seam and find the plate thickness for a cylindrical steel water tank 60 inches in diameter for a pressure of 50 pounds per square inch.

Answer.—In a problem such as this there are several unknowns, such as plate thickness, rivet diameter and rivet spacing. It is customary to give trial values to one or more of them as experience dictates, and from these calculate the others. Test calculations are then made to see that these values are such as to give the greatest efficiency.

The tension per inch on the seam is $\dfrac{60 \times 50}{2} = 1{,}500$ pounds. With a safety factor of 6, a tensile strength of material of 54,000 pounds per sq. in., and assuming a joint efficiency of 50 per cent., the thickness of the plate required is $\dfrac{1{,}500 \times 6 \times 100}{54{,}000 \times 50} = 1\text{-}3$ inch, or, say, $\frac{3}{8}$-inch plate.

There are a number of rules for determining the size of the rivet. One often used for smaller sizes is that the diameter of the rivet is made $\frac{3}{8}$ of an inch greater than the plate thickness. Likewise, assume a pitch of 2.5 diameters. The joint now becomes a single riveted lap joint with $\frac{3}{4}$ rivets spaced at $1\frac{7}{8}$ inches.

The shearing strength of the rivets per inch of joint $=$

$$\frac{\text{Shearing strength of rivet} \times \text{area of rivet}}{\text{Pitch.}}$$

or $= \dfrac{50{,}000 \times .4418}{1{,}875} = 11{,}991$ pounds.

The tensile strength of the plate between the rivets is

$$\frac{\text{Tensile strength of plate} \times \text{Thickness} \times (\text{Pitch—Rivet Dia.})}{\text{Pitch.}}$$

$= \dfrac{54{,}000 \times .375 \times 2.5}{1.875} = 16{,}200$ pounds per inch.

These dimensions, therefore, make the rivets much weaker than the plate. Decreasing the pitch to 1.75 inches, which is as small as we can conveniently make it and still have plenty of room for the riveting tool, we get for these values 12,620 and 15,911 pounds. The efficiency of this joint is the weaker of these divided by the strength of the uncut plate per inch, or $\dfrac{12{,}620}{20{,}250} = 62.3$ per cent. On account of the bending action of the lap joint, the actual efficiency would not run as high as this.

* * *

Question.—In the above problem what would be the effect of putting in another row of rivets behind these and at double the pitch?

Answer.—The shearing strength of the rivets is half as much again, or is

$$12{,}620 \times \frac{3}{2} = 18{,}930 \text{ pounds.}$$

The tensile strength of the plate becomes that between the rivets, in the outer row which is

$$\frac{2.75 \times .375 \times 54{,}000}{3.50} = 15{,}906 \text{ pounds per inch of length.}$$

Efficiency becomes $\frac{15{,}906}{20{,}250} = 78.5$ per cent.

The thickness of the plate could be decreased and the pitch of the rivets increased, tending to make the tank much lighter.

WELDING GALVANIZED AND TIN PLATES.

INQUIRIES are frequently made as to the possibility of obtaining satisfactory welds on plates or articles that have been galvanized or tinned. In most cases the welds obtained are excessively brittle, and in the case of welding galvanized material, the health of the welder is seriously affected by the fumes produced under the action of the blowpipe. It is therefore necessary for the welder to know the difficulties he has to contend with, and the methods to adopt in order to produce satisfactory welds on these materials.

Galvanizing.

Zinc forms a cheap and excellent protective coating for iron and steel. It has the great advantage over tin and lead in being attacked in preference to the iron when the two metals in contact with each other are exposed to corrosion. For most articles zincing—or galvanizing, as it is wrongly called—is most cheaply and conveniently applied by dipping the iron or steel articles in a bath of molten zinc. Previous to dipping the articles are cleaned by acid and friction, coated with a flux of sal-ammoniac and heated. With certain articles this method has disadvantages; for example, in large objects, tanks for instance, it is difficult to heat the molten zinc evenly, besides the bath would have to contain many tons of zinc. In these cases, the depositing of the zinc electrically, known as electro-zincing, has marked advantages. The zinc is deposited cold, and does not alloy appreciably with the surface of the iron to be protected.

The application of oxy-acetylene welding to finished galvanized articles is the exception rather than the rule. There are cases where, owing to the distance from a galvanizing plant, articles are constructed from galvanized plates and oxy-acetylene is applied during the construction. In other cases, the blowpipe is frequently applied to correct defects of manufacture, for example, welded or riveted tanks which have failed under hydraulic test. Lastly, the blowpipe is an indispensable tool for the repair of galvanized articles.

Galvanized Plate Welding.

In welding galvanized plates numerous precautions are necessary. The white jet of the blowpipe in contact with the plates produces abundant vapours and oxide fumes. These can interfere with the course of the work and, more important, seriously affect the health of the welder. Without proper preparation, the welds always include as impurities, zinc and slag, and the mechanical strength and soundness of the welds are directly dependent on the amount of such slag and zinc incorporated into the iron whilst molten.

The operation of hot galvanizing produces at the surface of the galvanized plate a layer of pure zinc and a series of intermediate alloys of iron and zinc, rich in zinc near the surface and rich in iron where the alloy comes in contact with the plate. As already indicated in describing the operation of cold galvanizing or electro-zincing, the zinc does not alloy appreciably with the surface of the iron. Under the action of the blowpipe the layer of zinc near the surface is volatilized, but this is not the case with the layer of alloy in contact with the iron or steel plate. Part of the alloy is dissolved in the iron, but the greater part forms a well-known earthy slag, and it is difficult to avoid its incorporation in the weld. The effect of including the zinc-iron alloy is to produce a very brittle weld, and the effect of incorporating the slag is to produce a defective weld with a consequent loss of strength.

Zinc Removal Imperative.

It is obvious that to produce good, sound welds on galvanized articles, it is necessary to remove the zinc from the vicinity of the weld. The zinc should be entirely removed for a distance of 1 in. to 1½ in. on either side of the centre line of the weld. This preparation makes the cost of the weld higher, and many firms neglect this precaution. Where the strength of the joint is of small importance, the direct application of the blowpipe may be sufficient. In such cases the health of the workman should be considered, and a suitable respirator be provided together with a plentiful supply of milk as an antidote. The plates should be bevelled as soon as the thickness reaches ⅛ in., otherwise burning of the iron and lack of penetration are sure to result.

The welding rod should be of Swedish iron, of dimensions appropriate to the thickness to be welded, and the power of the blowpipe should be that given for the welding of iron and steel plates of identical thickness, that is, the hourly consumption of acetylene should be 240 to 320 litres (8½ to 11 cubic feet) for every ⅛ in. thickness to be welded. The removal of the zinc in the vicinity of the weld also removes the protective covering and it is not usual to replace it by re-galvanizing. The superiority of zinc over other protecting metal coatings is important in this case as it is possible for the exposed iron to be protected by the surrounding zinc. It is advisable, however, to clean thoroughly the welded parts and paint them with a protecting paint having an aluminium base.

Tin Plate Production.

Tin plates are sheets of iron coated with a very thin film of tin. The manufacture of tin plate consumes the larger part of the world's output of tin. The plates resist the corrosive action of salts and acids, and tinned articles are commonly met with in practice. The process consists in annealing, washing, pickling and rolling the plates to get a good surface, they are then coated with tallow or balm oil previous to dipping in a molten bath of tin. The tin readily

CAPTURING TRADE

"Many people speak and write about capturing German trade, as if it were a merchantman just off the coast, which could be taken by one of H. M. gunboats," says a correspondent of the Building News, London, England, in a communication to that journal. "Trade really means the exchange of services, and as a matter of fact in the light of recent experience, the idea of capturing German trade has really become a back number.

"It is," he says, "ridiculous to talk of capturing foreign trade when we cannot retain our own trade. The lesson we have to learn is that we have paid a great deal too much attention to matters abroad and neglected—criminally, in my opinion, neglected—our own home affairs.

"We are building up foreign trade on paper that the first breath of adversity scatters. The wise man of old was right: 'The eyes of the fool are in the ends of the earth.' When we build our trade as most of your readers build their houses—for home consumption—we shall arrive. Then the Kaiser will have nothing to fight about."

alloys with the iron at the surface of contact, and a thin film of tin adheres to the alloy. Alloys of iron and tin, even when only traces of tin are present, are extremely brittle hot or cold.

Tin Plate Welding.

In the oxy-acetylene welding of tin plates, the tin is not eliminated as a vapor or as oxide fumes as in the case of zinc. Although tin melts at a low temperature (450 deg. Cent.), its vaporizing point is in the neighborhood of the melting point of steel (2,790 deg. Fah.), and further, the tin does not separate from the iron, but is entirely absorbed by the iron as soon as the latter reaches red heat, so that when the iron becomes melted by the blowpipe the iron-tin alloy is added to the molten bath. The result is that the weld consists of very large crystals, which are separated by numerous fissures or cracks.

In endeavoring to weld tin plates without preparation, the welder observes cracks forming behind the blowpipe during the execution of the weld. These cracks are produced by the expansion and contraction strains. For ordinary welds on iron and steel plates, these strains are either negligible or easily overcome, but in the case of tin plates they are sufficient to break up the structure of the iron-tin alloy which is formed during the course of welding. It is, therefore, absolutely impossible to weld tin plates satisfactorily without first carefully removing the tin from the line of welding and its immediate vicinity in the manner indicated for the welding of galvanized plates. The instructions given for obtaining satisfactory welds on galvanized plates hold good for tin plates.—Acetylene Lighting and Welding Journal.

Canada's War Orders.—Something of the truth of the statement made at the annual meeting of the Dominion Bank by Sir Edmund Osler in Toronto to the effect that Canada is being assisted rather than injured by circumstances arising out of the war may be gathered from the following figures representing approximately the orders of the British War Office agents for Canadian goods placed since the war commenced:—

Textiles and woolens	$8,000,000
Boots and shoes	9,500,000
Shrapnel shells and cases	25,000,000
Remounts	4,000,000
Harness and saddlery	3,500,000
Rifles and ammunition	2,000,000
Hardware of various kinds	2,250,000
Tinned meats	1,000.000
Canned goods	900,000
Clothing	8,000,000
Lumber	1,000,000
Miscellaneous	20,000,000
Total	$85,150,000

Observations and Comments on the Commonplace*

By John C. Jay, Jr. **

The accompanying article is neither more nor less than a plea for the greater display of business courtesy, and in order to accentuate the appeal, our actions and attitude in the social and domestic sphere are shown to reflect unfavorably on those generally practised in our business and its kindred relationships.

THESE are comments on the commonplace, the humdrum of every day routine, the small details of administration and personal conduct, which consciously or unconsciously must be worked out in every household or organization.

Each of us in the everyday regulation of our homes and individual lives gives some thought to the proper conduct of these homes, so that we may not be thought wanting in the generally accepted standard of the world for that station in life in which we move. The standard of living requires certain conditions from us which we must live up to, or else we suffer in standing in the eyes of our neighbors.

Inconsistency Marks Us.

It is a strange thing that the average man should feel that the minute he approaches his everyday business problem, a rather different standard is necessary, or rather, that no standard at all is required. An experience of somewhat over ten years as a salesman on the road and in the office, and in the daily running from one establshment to another in the pursuit of business, has forced home this unwelcome conclusion.

It is rarely that one comes upon an office that would measure up to the ordinary standards required and observed in private life. The man who is most scrupulous in his own home that his door bell be properly attended that the visitor within his gates shall be received with respect and courtesy, is particularly lax in these very matters where his business life is concerned. The slovenly slattern is not tolerated at the home door, nor would the average business man permit an untidy and often insolent boy to receive his visitors, but the gateway to the average office is manned by the cheapest of help, who eyes the visitor with intolerance and suspicion.

The Business Feature.

We go to see Smith in his house, and are ushered into the parlor, while Smith in his office permits us to warm a bench, if he has happened to think long enough to provide one. A wooden barrier with swinging gate securely locked by mystic mechanism, keeps us in our proper place, while the youth within fingers our pasteboard with grimy thumb, and asks us the nature of our business. The fact that our business with Smith may be of his own seeking, or the fact that we may be doing Smith a favor by our call, as a rule causes no discrimination. Smith, utterly unconscious, sits serene, far removed from the common rabble, behind a door, the heavy letters on which proclaim he must be "private."

No Monopoly Represented.

Our imaginary Smith is, I think, fairly typical. There is not a salesman who reads this article who does not number many Smiths among his acquaintances. Yet, strangely enough, Smith himself when finally reached is very human. He has the ordinary manners and the ordinary standards of the average man. He would probably be very much astonished if he knew the small tumult of anger he has unconsciously caused in our mind as we approach him. Yet the little scene in the front parlor of Smith's office is occurring every day in thousands of offices in every city in this country where business is being done. The cheapest help is put at the entrance gate of the business concern, which with its entire organization and its heavy advertising expense, is seeking customers.

The writer never sees the inevitable wooden barrier but that he asks himself the question, why, why, why, is it there? Through every intelligent means at its command, the company has made an effort to make itself known, to welcome custom, yet the first impression anyone entering its door receives is that entrance cannot be gained without proper credentials. For the sake of teaching the life insurance agent his place, of repelling peddlers and stopping the occasional deadbeat, an elaborate system is erected, that for stupidity cannot be matched, for while seldom excluding the really clever rascal, the self-respecting man on legitimate business bent is insulted and annoyed, and not infrequently excluded.

It is often urged that to provide suitable accommodations for visitors, in the shape of some proper waiting room, is costly and a waste of valuable space; in fact, so general is this opinion that the usual practice in large corporations is

*From Frog Shop Digest, Pennsylvania Steel Co.

**General Manager of Sales, Pennsylvania Steel Co.

that the visitor sits in what is usually the large working room or office, carefully kept in his proper place by a railing, and waits his turn to reach the man in the private office beyond.

Experiences of the System.

Not many years ago the writer was thus waiting his turn in the office of a large railroad, amid the clatter of many typewriters, and the hum of routine conversation inevitable in such a place. As he sat there, two clerks were calling off price lists to each other, for purposes of checking, thus giving him the very information as to his competitors' prices which the purchasing agent under no conditions would permit him to see.

Another experience also in a large railroad office, after a disastrous wreck, gave him information of a nature so confidential that no one outside of their legal department had any business to have knowledge of it. Under the ordinary practice existing in most offices, instances such as these must be the rule and not the exception.

Big Concerns the Biggest Sinners.

The larger the corporation, the less attention is given, as a rule, to these matters. The sense of individual responsibility does not extend to what many call a trifling and petty detail, and what is the business of all, becomes the business of none. The executive, the door of whose private home is faultlessly served, gives never a thought to the front door of his counting house, through which his income flows. Smith at home and Smith in the office have little in common.

The Personal Application.

We have been criticizing our good friend Smith because we feel he has not been running his business and reception room quite to suit our natures, possibly over-sensitive. To-day, however, Smith is a buyer, and with that sense of importance which always goes with ability to purchase, he has called upon us to see what trade he can make to mutual advantage. So that to-day the shoe is on the other foot, and Smith has come to us instead of our having to go to Smith.

I wonder if our sales offices and salesmen have ever stopped to study just the mental process which our good friend Smith goes through under these reverse conditions. In other words, does Smith find our own office intelligently manned at the entrance, and is he made to feel that he is welcome, and that of all places our office is the one where he will be intelligently served?

Distinctive Treatment Provision

Here again we find a ready standard of comparison between our individual life and home and our daily business routine. Were Smith to call on us at our house, we should get up—more, we should go half-way to greet him, and after the call was finished we would accompany him to the door as a matter of course. If we were living in the modern aparatment, merely a domesticated office building, and Smith were more than a chance acquaintance, we should probably show him the little courtesy of going to the elevator to bid him God speed. In our house we would feel that we were his host and would take pains to exercise the tact which is necessary to translate visitor into guest.

There is of course a ready distinction, and a very real one, to be made between our different callers at home and in the office. We make it quite naturally and unconsciously in our home as between the neighbor and the gas inspector. We may, therefore, make it quite properly in the office, but to our sales offices each stranger may be a customer, and as such he is to be welcomed on behalf of the corporation we serve.

Politeness Pays Dividends.

As a rather small boy the writer once was taken by his father on a business errand to the Chemical National Bank in New York, presided over at that time by a gentleman of the old school, whose traditions still linger in that particular bank. This bank, one of the oldest and one of the wealthiest in the country, serves an army of clients. What particularly impressed the writer as a boy was that at the close of the business in hand, this very busy bank president left his private office and walked to the door with us before the farewell was said. It was his universal custom.

The stories that grew up around this man were many. Even while talking to a client his eye took in the general coming and going in the bank, and if he saw any person not receiving prompt and courteous attention, the surprised depositor or borower might find himself being waited on by the president himself. A constant phrase of his to his clerks was "politeness pays dividends."

Each Salesman Reflects His Employer.

Each salesman is a point of contact with many individuals. It is the individual salesman more than any other man who fixes the standard by which a corporation is judged. He can reflect the character and policies of his company, and the company in turn is largely known and judged by his particular standard of conduct. Each in his small individual field is the creator of a certain amount of public sentiment, which in the aggregate approximates the whole The analogy between a large corporation and a government is obvious, and in this analogy the sales department of any large corporation corresponds closely to the diplomatic corps which any large government maintains.

The Business and Diplomatic Analogy.

In the diplomatic world, forms and formalities, customs and precedents, play a far more important part than in ordinary business life, yet the distinction is only a matter of degree. The diplomat or foreign representative who chooses to ignore these usual customary forms and formalities, no matter what his personal ability, creates an unfavorable impression, which in turn reflects discredit upon the country that has selected him as its representative.

So in turn, the salesman who thinks that perhaps it is unbusinesslike and shows lack of "hustle" to carry the standard of his every day life and manners at home into his business. makes a mistake and creates an impression, which if it represents the point of view of all, cannot fail to create a public sentiment detrimental to the corporation which employs him, proportionate exactly to the number of customers that salesman serves.

Of little value to a government is the high-sounding expression of friendship expressed in an arbitration treaty, if nullified in submission by the methods of a "shirt sleeve" diplomacy. Of little value are plant investment and business efficiency, if the salesman presenting these fails to make the proper approach.

A Reformation Call.

So let our own house be set in order. Let us reform our good friend Smith without his knowledge, for that is tact, and tact is salesmanship. By all means keep our own doors wide open. The open door spells welcome and dispels distrust. If we are tied up and busy (and even a salesman is busy and tied up at times), our visitor is entitled to know it promptly, for perhaps his business is quite urgent and his time quite limited. Let us dust and polish and furbish, that Smith may find pride of good housekeeping in our offices as well as our homes. Let us relegate the barrier gate and the truculent greeting to the period, long past, when flaunting suspenders and hatted head were badges of forced draught office activity.

Port Arthur, Ont.—Goods made in Canada will be given preference by the British Empire Industrial League, and goods made in Great Britain the next choice, according to an official communication received by Secretary Goodier, of the Port Arthur Board of Trade, from the headquarters of the league in London, England.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW DESIGN BORING MILL WITH CENTRE BORING HEAD.

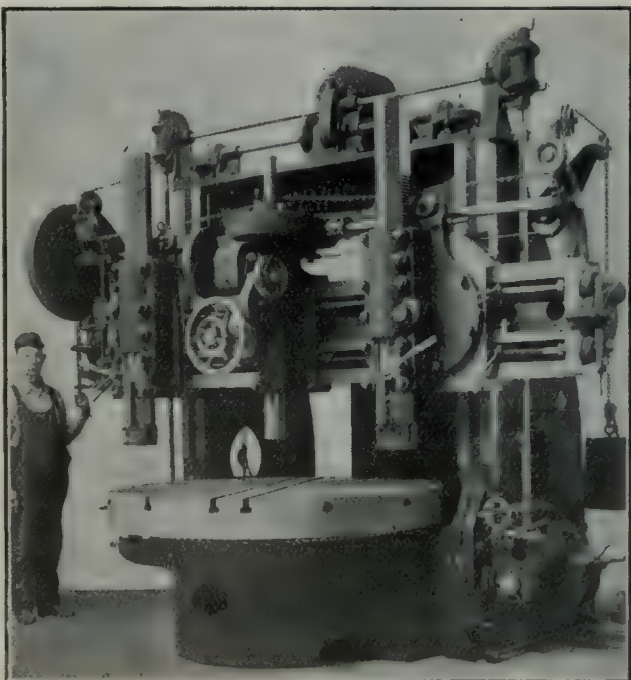
THE accompanying illustration shows the latest design 73 in. Niles boring and turning mill, equipped with centre boring head. This head is mounted on the rail between the two regular heads and is provided with adjustment along the rail by means of rack and pinion. The centre boring head can be traversed to the left, and the right hand regular head brought to to the centre of the rail and vice versa for the left hand regular head.

The spindle of the centre boring head is driven by a motor of three to one speed variation, mounted on the left hand end of the cross rail. Three positive feeds are provided, controlled by pull pin, conveniently located on the head. Spindle has rapid traverse by large hand wheel. On the horizontal driving shaft there is provided a clutch which disengages the drive from the centre boring spindle without rotating it. This is sometimes desirable when finish boring is done with the table revolving and the centre boring spindle stationary.

Centralized control is a prominent feature, all changes of feed and reversal, rapid power traverse or hand adjustment of saddles and bars, also cross rail adjustment and table control being within reach from the operator's position. One lever disengages feed, engages fine and coarse feed and operates fast traverse in either direction. A rapid power traverse to saddles and bars in either direction is provided, while hand adjustment of saddles and bars is by automatic releasing ratchets located at the sides of the saddles.

The whole machine is self-contained, no part extending below the floor line and no special foundation being required. The housings are of box-girder form, double webbed and broad-faced, without openings in front face between the housings. They are securely bolted to bed, and firmly tied together at the top by a heavy brace. The table is deep, strongly ribbed and supported by an annular bearing of large diameter running in a bath of oil, and is driven by a coarse pitch bevel gear, accurately cut, of maximum diameter and wide face. The surface of table has four pairs of parallel and eight radial T slots.

The table spindle is long and of large diameter, and is maintained in strict alignment by an upper and lower bearing. The former is bored out of the solid bed and fitted with an adjustable taper bush to take up wear. The lower bearing is bronze bushed. On the end of spindle is an adjustable threaded collar to prevent lifting. The cross-rail is of the 3-track type, having screw guide at the bottom with saddle traversing screw located between the guiding surfaces, giving the best possible condition for accurately guiding saddles. The cross-rail is box girder in form, broad faced, and of great depth to effectually resist heavy cutting, and may be readily clamped to the housings. Power adjustment is provided.



NEW DESIGN BORING MILL WITH CENTRE BORING HEAD.

The saddles have wide bearings on the cross-rail, accurately scraped, with provision for taking up wear by means of taper gibs. A clamp bolt is provided for clamping each saddle when bar is feeding. Swings are accurately graduated, and swivel by means of an arc worm at the top. The bars are massive steel forgings, octagon in form, scrapped to a bearing on four sides, allowing for taking up wear in all directions. The bars have continuous caps and a binder bolt is provided in the bottom of bar cap for locking the bar when saddle is feeding.

The feeds, eight in number, are positive, continuous and reversible, and independent for each head, both in amount and direction for down, cross and angular feeding. The tool holders are steel forgings, with provision for readily clamping tools for boring, turning and facing operations. They have straight shanks and are readily removable for the insertion of special boring bars.

Counterweights for each bar are attached to the same chain, but act independently, and will neither pull the swings over, nor interfere with the movement of the saddles. Counterweight chain is placed at the rear of the bars to prevent interference from overhead cranes when handling work on and off the table. Safety friction clutches located on the vertical spline shafts insure against accidents, in case heads or bars meet with obstruction when either feeding or fast traversing. All gears are guarded.

The different materials have been selected to give the best conditions for strength, rigidity and wear. All shafts are of high-grade steel, and the drive is bushed throughout with bronze. Taper gibs are used to take up wear on sliding surfaces. All driving, feeding, fast traversing and elevating gears are of very liberal diameters, pitches and faces; and steel, bronze, raw-hide and semi-steel are used with discretion to give the best conditions of strength, and at the same time, long wear.

The drive is by a direct-current motor of 4 to 1 speed variation, carried on a drive plate in the rear between the housings. Power is transmitted through a double run of clutch gears, giving two mechanical changes in speed, which, with the usual 16 or more speeds in the controller, gives 32 or more speeds to the table. Motor is fitted with push-button control and a dynamic brake for table. A separate motor, located on the top brace of the mill is furnished for elevating the cross-rail and providing rapid power traverse to bars and saddles.

Belt drive through a single pulley or alternating current motor drive by constant speed motor is through a speed

box and back gear located in the rear of the mill, giving twelve changes of speed. All gears in speed box are of Cycloid gear steel, of approximately 200,000 pounds tensile strength, treated and hardened. Speed box is fitted with a hand-operated friction clutch for starting and stopping the table. A brake is provided, and is controlled by the same hand lever at the right hand side of the mill which operates the clutch.

A separate motor, located on top brace of the mill, is furnished with a.c. drive for adjusting cross-rail, and providing rapid power traverse to bars and saddles. Belt-driven machines are built on the convertible plan, and may be readily changed to motor drive.

Boring mills of this design are built in 44 in., 53 in., 62 in. and 73 in. sizes by the Niles-Bement-Pond Co., 111 Broadway, N.Y., and the particular machine here described was supplied by them to the Troy Engine & Machine Co., Troy, Pa.

BALL-BEARING POLISHING AND GRINDING MACHINES

THE description and illustrations refer to two recent products of the F. E. Wells & Son Co., Greenfield, Mass., being known respectively as their No. 10 Ball-bearing Polishing Machine and their No. 11 Ball-bearing Grinder. The polishing machines are arranged to be driven from the shaft attached to the ceiling of the room beneath, or if the building is only one storey, then the shaft can be run in a trench with the shaft bearings upheld by floor stands. The idler pulley for tightening the belt is located inside the base and is raised or lowered by means of the handle on the outside of the latter.

When starting up, the pulling up of handle forces the idler pulley against the belt, thus taking up all slack, and when it is required to stop the machine, the controller handle is simply lowered. The ball bearings are specially enclosed and completely protected from dust. The diameter of spindle in bearings is 1.7725 inches, diameter of arbor $1\frac{1}{4}$ in., diameter of wheel flanges 5 in., height of spindle from floor 36 in., size of base 17 x 22 in., net weight 510 pounds.

The No. 11, or grinding machine, is similar to the No. 10 polisher, except that an overhead drive is arranged.

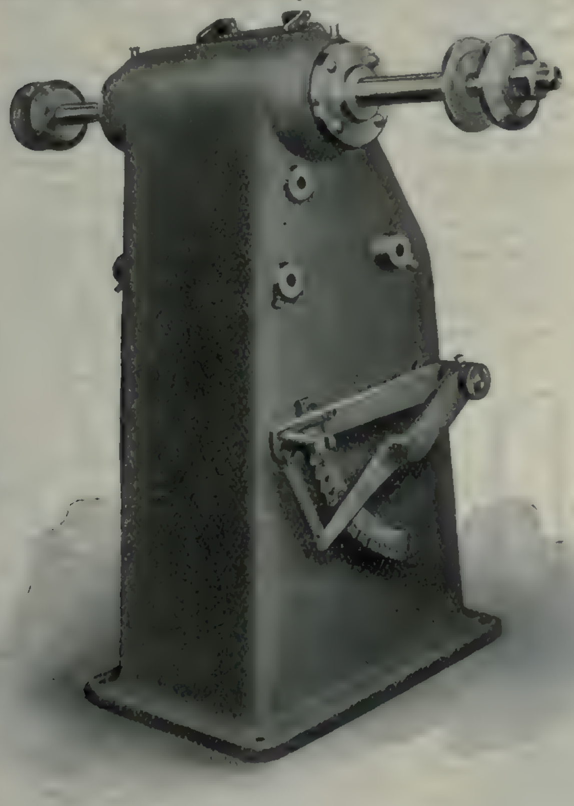
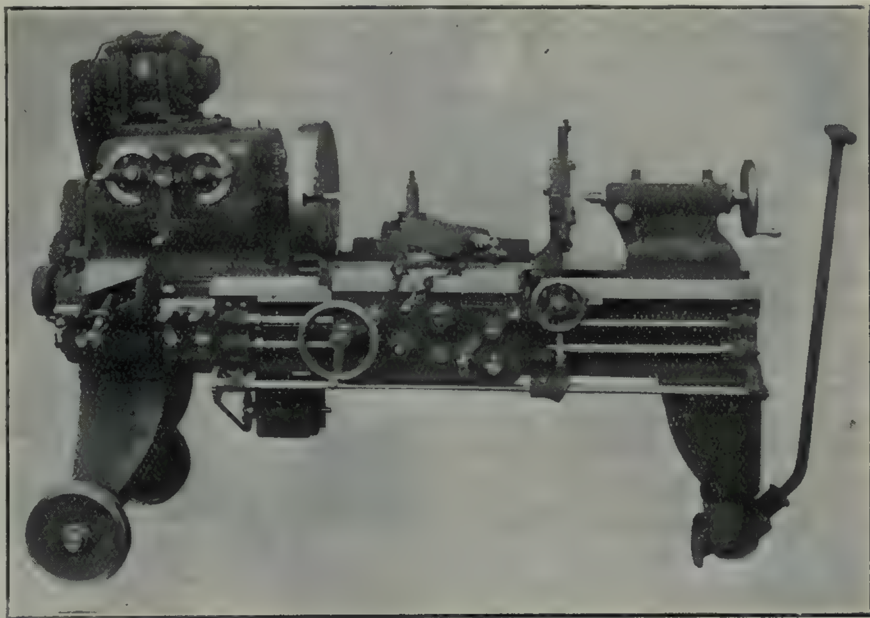


FIG. 1. BALL-BEARING POLISHING MACHINE.

FIG. 2. GRINDING MACHINE WITH BALL BEARINGS.

RAILROAD SHOP PORTABLE LATHE.



16 INCH HIGH DUTY RAILROAD SHOP PORTABLE LATHE.

THE accompanying illustration shows a portable lathe, recently built by the American Tool Works Co., Cincinnati, Ohio, for a large railroad shop. It is intended for use in the latter, also in large ma-

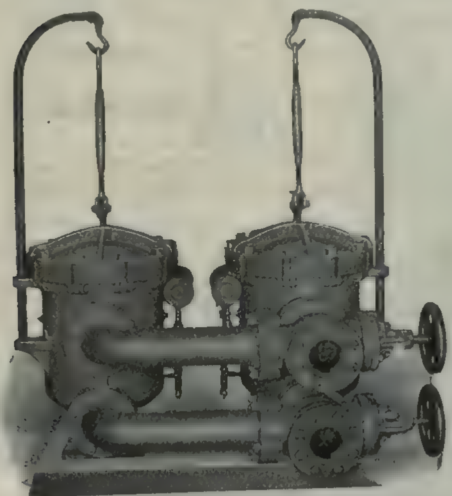
chine shops where it is more economical to take the machine to the work instead of vice versa.

The unit consists of the regular 16-in. American high-duty lathe, with patented 8-speed geared head for motor drive, and all standard equipment, such as unlimited quick-change gear mechanism, double plate all steel geared apron, chilled bed, heavy 4-bolt tailstock and bronze bearings throughout; the whole mounted on three wheels and provided with a long lever for hauling about the shop. Being given a 3-point bearing on the floor, the chances of its getting out of alignment are very slight, even where the floor is uneven.

This machine being complete in every respect, is a very handy and useful tool, being ready for service in any part of the shop at a moment's notice.

THE BLACKBURN-SMITH TWIN FILTER.

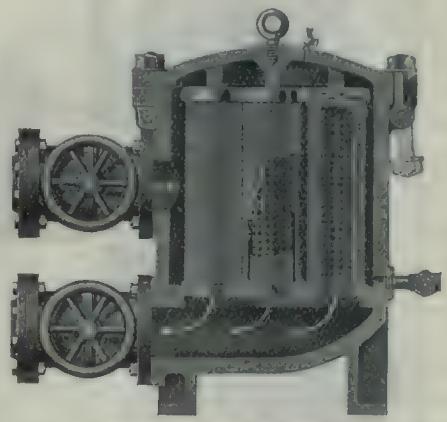
A NEW type of Blackburn-Smith feed water filter and grease extractor, having twin bodies controlled by a single set of inlet and outlet valves, is now being



TWIN FILTER. REAR VIEW.

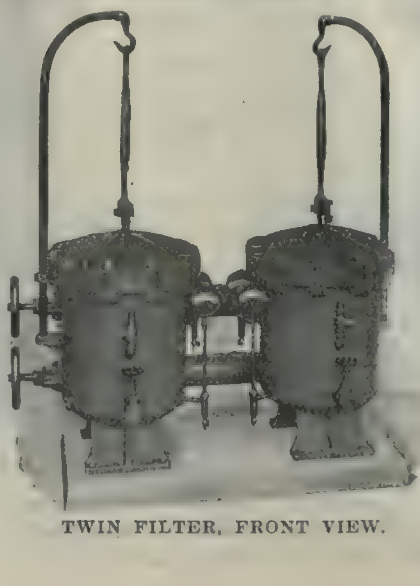
built by James Beggs & Co., of 38 Warren Street, New York, N.Y. The ever-increasing number of plants which carry loads varying greatly at different times, or which operate twenty-four hours per day, has necessitated the design of filters which have considerable flexibility as to capacity, and which permit of the cleaning of one part while the other is in operation. It is readily seen that if a filter of this type is selected of such size that either side alone can carry the regular load, then the two sides can be thrown in during the peak load, thus permitting the thorough filtration of all the water at all times, and without interference by the necessary cleanings. The turning of both valves to one limit by-passes the corresponding body, and the other body is by-passed by turning both valves to the other limit, thus permitting the alternate operation and cleaning of either side. The combined operation of both sides as would be desirable during the peak load is accomplished by turning the valves to mid-position.

The filter is made up of a number of parts, so that breakage or disarrangement of any particular section does not necessitate the discontinuance of all



SECTION OF FILTER.

filter service, and as these machines are tested to 400 lb. hydrostatic test pressure before shipment, the probability of such interruption of service from defective material or workmanship is minimized. The valves are of the double seat type and the disc between is self-seating, thus preventing leakage due to dirt deposited on either disc or seat. The filter chests are the same as in the single type of Blackburn-Smith filter—each divided into an inlet and an outlet chamber by a partition carrying the filtering cartridges. Each cartridge consists of two concentric perforated brass cylinders so covered with linen terry cloth that two uniform separated and successive filtering surfaces are put into the path of all entering water. The opening of the filter for cleaning is facilitated by the use of a large cover held by swing bolts. A crane and turnbuckle lifts, swings and holds the cover during cleaning with a minimum of labor.



TWIN FILTER, FRONT VIEW.

MARKING A CHEQUE "IN FULL SETTLEMENT."

THE opinion is widely entertained in trade circles that when a cheque is marked "In full settlement" by the drawer it cannot be retained and treated as a payment on account. A case recently tried in the City of London Court serves, says the Draper's Record, as a reminder that this doctrine must not be accepted without qualification. The plaintiff kept the cheque so marked and subsequently sued his debtor for the balance of the account. The court held that he was within his rights in so doing. It is, therefore, clear that the mere endorsement of the cheque is not to be interpreted as meaning that the recipient agrees to the special condition set out on the face of it. At the same time it may be presumptive evidence of an agreed settlement. Each case will have to be determined on the facts.

Probably the most satisfactory course to pursue in such circumstances would be to send the cheque back, declining to accept it in settlement. No misunderstanding could then occur, but, as the judge pointed out, it might result in the creditor being kept out of his money for several months. The subject is not free from difficulty, but commercial sentiment generally would be opposed to accepting a cheque so marked and then repudiating the condition. This, of course, is not to say that circumstances could never justify such conduct.

DOMINION FISCAL RETURNS.

DURING January the national debt of Canada increased by $18,634,352. It now stands at $395,378,516, an increase of nearly $80,000,000 as compared with January 31 of last year.

The revenue for the last month was $9,897,664, as compared with $11,529,753 in January of last year. For the first ten months of the present fiscal year the revenue has decreased by $30,000,000, as compared with the corresponding fiscal year, the total revenue of the past ten months being $109,533,607. The decrease in customs duties for the month of January was a little over two millions, and for the ten months about twenty-eight millions.

Expenditure for the ordinary cost of administration for the ten months totalled $101,956,366, an increase of about nine millions, as compared with the first ten months of 1913-14. Capital expenditures for the past ten months have totalled $36,753,359, a decrease of approximately ten millions on the corresponding period of last year.

Temporary loans made by the Dominion Government now total $48,799,999, as compared with $18,006,666 a year ago.

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Vol. XIII. FEBRUARY 11, 1915 No. 6

PRINCIPAL CONTENTS.

STIMULATING BUSINESS.

It would be idle to even pretend that business in its every individual as well as collective sense is being nourished and stimulated as it should. For many months now the disposition has been altogether the reverse of this, the gospel of extreme caution and rigid economy being both zealously preached and practised. Throughout the length and breadth of our land the cry has gone forth that we have in the past been altogether too extravagant, by which term we assume that we have been much too prodigal with our own and other people's cash.

Immunity from the sweeping assertion there is none, we are taught to believe, whether in the individual or corporate feature, and the result is that in numerous instances without semblance of reason, we opine that it must be true. In a word, the continual patter—chatter is perhaps more appropriate,—about retrenchment has overwhelmed us, as by an anaesthetic, and reason has given place to imagination. A good many years ago, an article appeared in Chambers's Journal, with the title "Can Imagination Kill?" The writer, without having to theorize much, showed that imagination could and did kill, and we in Canada to-day bear unquestionable testimony to the conclusions then drawn. We have allowed our imagination to practically kill Canadian business enterprise in its every feature.

At this late day there still lingers the idea that certain specific happenings in which the public are involved can be kept private, and that only those who direct the particular transactions therewith connected really count. Intelligence is still reckoned to be at a low ebb among the public generally, and in any case the individual constituents of that public are so engrossed in the affairs of their own little circumscribed world that they are hopelessly blind to what takes place beyond, or even over their shoulder. Canada cannot build submarines and manufacture shells, clothing and other munitions of war for her own or the allies use, without the world knowing it, much less her own citizens knowing it and, without finally, the latter becoming sufficiently interested as to become equally familiar with the multitudinous details and to quite rival in first hand information acquired, those charged with the planning and adminstration of the particular undertaking. In like manner, our railroad and manufacturing corporations cannot start and continue to practise retrenchment necessary or otherwise without our people in their every sphere making mental note of the shortening of sail and proceeding to do likewise.

Manufacturing Canada has impressed unfavorably agricultural Canada, and without justification. The business depression has little, if any, connection with our farming interests, yet the latter intuitively have proceeded to conserve their resources and quite unwarrantably so just, by reason of the propaganda of the manufacturer and financier having been so bountifully broadcast.

There is far too much disposition on the part of our business interests to anticipate and to make themselves believe that still harder times are in store for us, and too little realization that what lies in the near future will be just what we choose to make it. The efforts of the past six months have been solely directed to conservation with the result that so far as our industries are concerned we are in about as bad a plight—barring annihilation as any coming months can make us.

The gospel of efficiency made many converts in the past few years, and had many exponents, but to-day when the real need for its application and propagation exists as never before, the preachers are silent and the subject ignored. The economy being practised within our borders at this time does not necessarily arise from or contribute to any standard of efficiency, rather is the widespread continuance of the trade depression attributable to the lack on the part of each individual concern and the units composing it of maintaining, when business suffers a jolt, the standard set in prosperous times.

It is not enough to believe that the Allies are going to win out, they must employ the means to that end; likewise, while we believe that business will come all right in Canada in time, it is equally incumbent that we as individuals apply ourselves to that end. The worst is past if we will only be optimistic enough to believe it and put our convictions into practice.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00
Hamilton, No. 1	18 00	17 00
Hamilton, No. 2	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal.	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.10
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.10
Beanms and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 9 00
Copper, crucible	10 00	10 00
Copper, unch-bled, heavy	9 50	10 00
Copper wire, unch-bled	9 50	10 00
No. 1 machine compos'n	8 50	9 00
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	4 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake Copper, carload	$15 25	$15 25
Electrolytic copper	15 15	15 00
Castings copper	14 75	14 75
Tin	38 50	39 00
Spelter	8 50	8 50
Lead	4 75	5 25
Antimony	18 00	19 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard, Nom. Diam.	Standard, Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	.1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Jan. 8, 1915:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal
	Standard			
¼, ⅜ in.	65½	50½	....	....
½ in.	70½	59½	....	....
¾ to 1½ in.	75	65	....	....
2 in.	75	65	71	61
2½ to 4 in.	75	65	74½	64½
4½, 5, 6 in.	....	....	72½	62½
7, 8 10 in.	....	....	69	58
	X Strong P. E.			
¼, ⅜ in.	58	48	....	....
½ in.	65½	55½	....	....
¾ to 1½ in.	69½	59½	....	....
2, 2½, 3 in.	70½	60½	....	....
2½ to 4 in.	....	....	67½	57½
4½, 5, 6 in.	....	....	67½	58½
7, 8 in.	....	....	60½	49½
	XX Strong P. E.			
½ to 2 in.	44	34	....	....
2½ to 4 in.	....	....	44	34
	Genuine Wrot Iron.			
⅜ in.	59½	44½	....	....
½ in.	64½	53½	....	....
¾ to 1½ in.	69	59	....	....
2 in.	69	59	65	55
2½, 3 in.	69	59	68½	58½
3½, 4 in.	....	....	68½	58½
4½, 5, 6 in.	....	....	65½	55½
7, 8 in.	....	....	62	51

Wrought Nipples

4 in. and under	80%
4½ in. and larger	75%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.68
Linseed oil, boiled, single bbls.	0.71
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

1/4 inch	$7.25
5/16 inch	5.10
3/8 inch	4.35
7/16	4.05
1/2 inch	3.80
9/16 inch	3.80
5/8 inch	3.65
3/4 inch	3.60
7/8 inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
1/4 in.	6.25
5-16 in.	4.65
3/8 in.	4.00
7-16 in.	4.00
1/2 in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 09¾
X Grand	0 09¼
XLCR	0 08¾
X Empire	0 08
X Press	0 07¼
COLORED.	
Lion	0 06¾
Standard	0 06
Popular	0 05½
Keen	0 05
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 06½
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06
Dark Colored	0 05

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 8, 1915.—Industrial conditions remain very much the same as those prevailing during the last few weeks. The outlook is, if anything, rather brighter. It is hard to separate business from the events of the war, and the developments of the last few days relative to shipping have served to give more emphasis to the fact.

The steel business continues to be fairly active in merchant bars, but building sections are not in much demand. Machine tools are still in a rather novel position, the demand being large along certain lines and practically nil in others. The foundry department is still much as it has been since the outbreak of the war, little change being apparent either way. Recent events on the high seas seems to have had a more or less direct effect on metals. These, being largely required by the belligerent powers, are in great demand, and their production, sale and shipment of the various metals are, therefore, surrounded by interesting circumstances.

The Steel Market.

The steel trade, in as far as supplies for munitions of war are concerned, is good. Merchant bars are in good demand also. The railroads are only placing nominal orders, although it was anticipated that these corporations would be buying more extensively at this time. Some small orders for marine castings and forgings have been placed. Inquiries of a general nature are coming in

very freely, but not a great deal of business is being placed; however, it is confidently expected that encouraging developments will take place in the next few weeks.

Pig Iron.

The general slackness in the pig iron market still continues. Foundries operating are doing so greatly under capacity, and business passing is only for small lots. Prices continue to remain at very low figures. Orders taken for delivery in the second quarter are common, as a consequence an increase in price is not anticipated.

Machine Tools.

It is a difficult matter to purchase certain tools which are used in the manufacture of shrapnel shells at the present time. The placing of further orders for shells in Canada has created a demand for turret lathes and grinders in excess of the supply at hand. In other lines there is little business moving. In short, the machine shops of Canada have been largely turned into factories producing ammunition. Thus the demand for tools is almost confined to those required in this line of manufacturing. The demand for supplies is improving as the war orders increase. Prices, however, remain unchanged except in a few instances.

Metals.

The metal market again has been the scene of more or less interesting manipulation. Copper seems to have been the centre about which most of the interest has collected. A huge amount of this metal is being shipped to Europe, largely for the use of the allies. Although the price of tin has not advanced during the week, the tone remains strong and an advance may be anticipated. Spelter has gone up one cent per pound, and the supply is apparently being cornered. There ought to be sufficient spelter produced to supply all demands, and it is rather hard to understand why the price should be so stiff. Lead, tin, and antimony have all been rather quiet, and no change in prices have been reported.

Toronto, Ont., Feb. 9, 1915.—There is little change in the industrial situation to note this week, although the outlook is gradually brightening. Factories engaged on Government contracts are very busy. Large orders are being distributed, and these are tending to develop business along lines approaching to normal. The increase in production will materially benefit a large number of people and put a considerable amount of money in circulation. The export trade of the Dominion is expanding, although the volume of imported goods has declined, not altogether an unfavorable feature, except for the resultant loss in revenue, which for the year 1914 reached the total of $18,000,000. The budget speech, which will be delivered on Thursday, is being awaited with interest in business circles, and there is a considerable amount of conjecture as to the exact policy the Government will adopt. It is generally thought, however, that a general war tax will be announced.

The iron and steel market remains dull, and prices on bars, plates and shapes are weaker. The scrap metal market is dull and getting weaker, although prices are unchanged. The pig iron market is stagnant and prices are unchanged. The demand for machine tools for making shells continues and the number of plants engaged in this business is increasing. Supplies are slow, with no change in prices. The metal markets are strong, copper, tin, spelter, lead and antimony all having advanced, due to conditions in the primary markets.

Steel Trade.

The steel market is still in the same dull condition as during the past few weeks, and the outlook for any immediate improvement is not particularly bright. Prices on Pittsburg bars, plates and shapes for local consumers are weaker, which may stimulate business; $1.10 f.o.b. Pittsburg is now being quoted. The contract for the Rosedale section of the Bloor Street viaduct has been awarded to the Dominion Bridge Co. This will be built of steel, and will cost $298,555.

The steel market in the States is looking better this week, and prices on bars, plates and shapes have an upward trend. The number of furnaces in blast is gradually increasing, and a further increase in output is looked for. Galvanized sheets have advanced on account of the high price of spelter.

Pig Iron.

The pig iron market is uninteresting, and comparatively little iron is moving. The situation in Buffalo is improving, and prices are firmer.

Machine Tools.

There has been rather less activity in machine tool circles this week. The business being booked is almost entirely for machine tools, grinders, etc., for shell manufacture. The number of plants engaged in this business is increasing, and local dealers are busy figuring on suitable equipments. A number of nice orders for tools have been booked by local machinery houses recently.

Supplies.

There is a fair demand for machine shop supplies, but orders for the most part are for small lots. There has been no change in prices during the week, although it is expected that linseed oil will go higher in the near future.

Metals.

Notwithstanding the comparatively light demand locally for most metals, the markets for the most part continue to advance. This is accounted for by the strength of the primary markets, which are subject to different conditions from what obtain here. Tin is strong, and has advanced 1½c, being now quoted at 39c per pound. The strength of the tin market is accounted for by the congestion in the port of London. The copper market is firm, and prices are higher at 15¼c per pound for lake. The spelter market is higher on account of heavy demand from Europe and from the brass mills, which are busy on war materials. Spelter has advanced 1c, and is now quoted at 8½c per pound. Lead is firm at 5¼c per pound, being ¼c higher. The antimony market has advanced 1c, and is firm at 19c per pound. Aluminum is unchanged at 22c per pound. Solders have advanced in sympathy with the tin market.

St. John, N.B., Feb. 6, 1915.—Conditions in general manufacturing and machinery business throughout New Brunswick continue to be quite encouraging, and proprietors of local houses are making no complaint as regards their share. In some lines there has been increased activity since the war owing to participation in army contracts, and this has reflected upon business in other branches of industry. Prospects are bright for a good season in lumbering, provided weather conditions and supplies of snow are favorable, and since the lumber trade influences various other lines of business in New Brunswick, generally speaking, other commercial interests are well sustained, if it be prosperous. Shipments through St. John to the Old Country are considerable, and maritime business has kept up quite steadily. In some of the smaller towns, of course, there has been a slow period, but on the whole conditions are very satisfactory and, compared with reports received and statistics from other centres, are to be regarded as highly encouraging to the manufacturers throughout the province.

Army Contracts.

The matter of the manufacture of shells for use of the allies has engaged the attention of local iron manufacturers, and an interesting announcement in this connection is that the Messrs. Fleming, of the Phoenix Foundry, are vigorously proceeding with the changes and additions to their plant necessary to enable them to handle a big contract for shrapnel shells received from the War Office. Special equipment

is necessary and its installation is now in progress. The work will be prosecuted by night and day shifts.

H. Horton & Son, leather manufacturers, received an order for 600 sets of saddlery for the Russian Government, the total cost of which will be about $43,000, with delivery guaranteed for March 31. Their factory is being run night and day in the performance of the contract. Other firms have been favored with war contracts also.

The new sugar refinery in St. John, owned by the Atlantic Sugar Refineries, Ltd., one of the finest and most up-to-date in Canada, is about completed, and operation will start in a few days. The machinery in the new building, which is several storeys in height, and located on the water front, has been running on test for some weeks, and has proven entirely satisfactory.

Persons interested are fully expecting that the Hewson Pure Wool Textiles, Ltd., of Amherst, N.S., will resume operations in the near future. At a recent meeting of a joint committee of the Amherst Town Council and Board of Trade with the directors of the company, a plan was agreed upon which is expected to result in the resuming of work by this big house with their splendid factory. Recommendations have been made that the bondholders buy up the company, and a meeting of these latter is to be held on February 11 to decide upon this. That $150,000 new capital be raised for working purposes was urged, and promises of Government contracts in connection with the supply of war woolens were intimated.

A real estate deal of large proportions has been effected in St. John whereby the big lumber interests and harbor rights of Hilyard Bros., in Strait Shore, have passed to J. S. Gregory. This includes a big lumber plant, wharves, docks, and other essentials, and is one of the most important real estate transactions of recent date locally.

New Brunswick's Chance.

While in the city recently, H. P. Timmerman, Industrial Commissioner for the C. P. R., speaking to a representative of "Canadian Machinery," dwelt in an interesting way upon the opportunities of New Brunswick industrial enterprises to enter new markets and to share in the trade lost by Germany and Austria owing to their sea outlets being closed. Raw material and its production were the keynotes to this question, Mr. Timmerman said, and the attention of manufacturers not only in New Brunswick, but all through Canada, should be directed to the sources of supply near at hand. The "Made-in-Canada" campaign had been productive of splendid results, and he thought it should be encouraged and enlarged.

Speaking of the lumber trade, he referred to the fact that in Ontario last year woodworking factories had imported $5,000,000 worth of hardwood, the greater part of which it would have been possible to secure in Canada, much of it in New Brunswick. The operators in this province, he thought, should seek Ontario as a market for birch in particular, and he believed quite a trade could be established.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Renfrew, Ont.—Thomas Pink & Co. have secured a contract for the manufacture of shells.

Essex, Ont.—The Town Council is considering the purchase of a steam pump and boiler.

Barrie, Ont.—Fire at the Barrie Foundry Co. of Jan. 21 caused damage to the extent of $1,300.

Hamilton, Ont.—Machinery will be purchased by A. Anderson, care of Procter Gamble Co., Ivorydale, Ohio, for the new $1,000,000 soap factory the company is erecting at Hamilton, Ont.

The Montreal Locomotive Co. has booked an order for shrapnel shells and has already purchased hydraulic projectile presses. Other equipment will be purchased.

Jas. Steele, Ltd., of Guelph, Ont., makers of wire springs, have recently installed automatic machinery for making upholstering springs for the automobile and furniture trade.

The Canadian Fairbanks-Morse Co., Toronto, have sold a number of tools to the Dominion Chain Co., Niagara Falls, Ont., including Brown & Sharpe, millers and surface grinders, radial drills, lathes, grinders, etc.

Lindsay, Ont.—At a special meeting of the town council held on Feb. 4, a proposition to guarantee the bonds of the Boving Co., of Canada, for $30,000 was introduced. A by-law will be submitted to the ratepayers authorizing the guarantee.

Shrapnel Shell Order.—The Collingwood Shipbuilding Co. have received their first order of shrapnel shells from the Canadian Government, and although the quantity is not named we understand it to be large and the forerunner of further orders. Production will be started immediately, the necessary machinery purchased has been installed.

New Westminster, B.C.—The building and plant of the Westminster Wire and Nail Works, on Lulu Island, have been acquired by G. W. Laidlaw, of Vancouver. Mr. Laidlaw has already started to transfer his Vancouver plant to the new location, where operations will be started immediately. He specializes in crosshead bale wire for baling hay and in barrel hoops, and the plant will also turn out staples.

Canadian Copper Co.—It was officially announced by the Canadian Copper Co. that mining operations are to be resumed at No. 2 and Crean Hill mines, and the two idle furnaces at the smelter at Copper Cliff are to be started up forthwith. No. 3 mine will not be started, neither will the reverberatory furnaces. In a very short time, therefore, the mining and smelting operations of the company will have returned to normal output, as existed previous to the outbreak of war last August.

John S. Metcalf Co., Ltd., of Montreal, is designing two elevators for the Arthur Guinness Son & Co., the famous Dublin brewers. The two elevators are for their new plant at Manchester, England. One of them will have a capacity of 835,000 bushels, and will receive, store and clean barley. The second elevator will have a capacity of 600,000 bushels, and will be used exclusively for malt. There will be in addition facilities for handling both sack and bulk grain from boats and from cars. Both structures will be of concrete. The cost of the work is approximately $600,000.

Municipal

Vernon, B.C.—The council contemplate extensions to the sewage disposal plant.

Regina, Sask.—The Commissioner recommended that the contract for valves be given to J. H. Ashdown Hardware Co.

Alexandria, Ont.—Extensions are contemplated to the waterworks system and electric lighting plant at an estimated cost of $5,000.

Wallaceburg, Ont.—The town has taken over the electric light plant hitherto owned by a private company. The purchase price was $36,976.

Winnipeg, Man.—Mayor Waugh has stated that the city will spend $3,000,000 this year on the Greater Winnipeg aqueduct and other necessary works.

Port Alberni, B.C.—The council will purchase from Waterhouse & Greene, of this city, 1,900 feet of 6-in. and 450 feet of 8-in. sewer pipe. Total cost, $500.

Brockville, Ont.—A 4,000,000 gallon filtration plant will probably be installed. F. A. Dallyn, Provincial Sanitary Engineer, has reported in favor of filtering the water supply.

Orillia, Ont.—The council, at its meeting on Feb. 1, approved of the principle of paying a commission to a publicity agent who is locating English and American industries in Canada. The commission will be based on the amount of wages paid by such new industry as may be located by him in Orillia.

Ottawa, Ont.—J. B. McRae, consulting engineer, to whom has been entrusted the work of preparing plans for the Lemieux Island overland pipe for submission to the Provincial Board of Health, visited Toronto recently to submit plans to the Board.

Brockville, Ont.—On February 2, at a joint meeting of the Council, the Board of Health and the Water Commission, action was taken to extend the intake pipe, to consider the cost of a filtration plant, and to arrange for changing the discharge of the sewer west of the town into the main sewer instead of the river.

St. Thomas, Ont.—The City Council is again moving toward securing natural gas. A special committee was named at their meeting on February 3 to prepare a statement of what the charges would be if the city used natural gas, and to obtain any other information they deem necessary, and to report to the chairman of the finance committee as soon as possible.

Toronto, Ont.—Four sections of the North Toronto waterworks system will be done by contractors. Commissioner Harris' figures were considerably in excess of contractors' figures, and contracts were awarded as follows:—W. H. Murphy, $16,147.50; J. A. Maguire, $16,882.50; J. H. McKnight, $17,790, and J. H. McKnight, $8,345.50. Labor will, to some extent, be drawn from the civic employment bureau.

Ottawa, Ont.—It is said that the Dominion Cabinet have been watching closely the proceedings of the city council regarding the water question in Ottawa, and that the matter will receive some consideration during the forthcoming session. It has been stated that the offer of the Government towards a scheme for bringing mountain water into the city is $100,000 per annum, but that this may be increased to $150,000.

Toronto, Ont.—The Commissioner of Works has recommended that the con-

tract for the construction of the Rosedale section of the Bloor Street viaduct be awarded to the Dominion Bridge Co., and the recommendation has been sent on by the Board of Control. The Dominion Bridge Co. tender was $312,458 for the section complete, or $298,555 for the section minus the lower deck. Commissioner Harris selected the latter tender.

General Industrial

Windsor, Ont.—A factory is being erected by the Windsor Mfg. Co.

Quebec, Que.—The Touriguy & Marois Co. expect to begin operations at their new shoe factory early in March.

Woodstock, Ont.—The creamery established at Beachville by the Wm. Neilson Co. of Toronto was opened on Jan. 25.

Montreal, Que.—The Maple Leaf Shoe Co. factory was destroyed by fire on February 3. The damage is estimated at $15,000.

Cranbrook, Alta.—Harry C. Moore of Blairmore, Alta., is interested in a company who propose to establish a wood distillation plant here.

London, Ont.—It is stated that James Playfair, of the Canadian Navigation Co., plans to build a grain elevator at Port Stanley at a cost of $100,000.

Maisonneuve, Que.—The Montreal Toy and Novelty Co. is asking for exemption from taxation on a factory which they will erect here for the manufacture of toys.

Lethbridge, Alta.—A Magrath report states that the Ellison Milling Co. are considering erecting a new elevator there to replace that destroyed by fire over a year ago.

London, Ont.—Gordon Philip, Industrial Commissioner, has announcel that negotiations have been completed for the establishment of two new industries by the spring.

Guelph, Ont.—An important industry which will employ quite a number of hands is in communication with the civic authorities, who are doing all in their power to induce them to locate here.

Carlstadt, Alta.—Fire destroyed the West Grain Co. elevator here on Jan. 24. The elevator had five thousand bushels in it at the time and the total loss is about $20,000, partly covercred by insurance.

Fort William, Ont.—It is reported that Barnet & McQueen have been awarded the contract for the new addition to the Ogilvie Flour Co.'s elevator here. The capacity of the elevator will be increased by 750,000 bushels.

Toronto, Ont.—The Rudd Paper Box Co. have applied for a permit to rebuild that section of their factory recently destroyed by fire. The cost will be $30,000. The company hope to have their 175 employees back to work in six weeks.

Guelph, Ont.—Messrs. Alex. Simmers and W. Shiply, Canadian manager of the New Idea Spreader Co., whose headquarters are at Coldwater, Ohio, have been in Guelph looking over the ground in connection with the proposed Canadian factory.

Quebec, Que.—Legislation will shortly be introduced in the Provincial Parliament to provide for another $10,000,000 for the good roads programme of the Province. This loan of $10,000,000 will likewise be available for completing the national highways from Montreal to Quebec for which the Government assumes the entire cost.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and Mr. F. W. Stobart, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Toronto, Ont.—The five-storey building of the Rudd Paper Box Co., 372 to 376 Richmond street west, was gutted by fire, which broke out shortly after one o'clock on Jan. 27. The building was valued at $65,000, the contents $35,000, and the plant and equipment $75,000, a total of $175,000. The insurance will amount to $108,000.

Walkerton, Ont.—At a joint meeting of the Board of Trade and the Town Council on February 1, with a view to taking steps to secure contracts for war materials, offers were read from the Walkerton Electric Light Co. and R. Truax & Son, offering free power for any factory securing such contract and manufacturing in Walkerton during the war.

MacLeod, Alta.—The MacLeod Flouring Mills, Ltd., whose elevator was destroyed by fire a few weeks ago, has leased the Alberta Co-operative elevator at this place and will carry on their business as usual. In the meantime they are making preparations to rebuild and expect to have their own elevator completed before next season's crop is harvested. A. J. Maley is manager.

Toronto, Ont.—The report of the Ontario Highways Commission that the Ontario Government spend $30,000,000 on good roads throughout the province will not be adopted by the Government. The cabinet has decided not to introduce any bill asking for permission to borrow $30,000,000 for road purposes. Good roads legislation is still under consideration, but the measure to be brought down will not cover more than a few million dollars.

Owen Sound, Ont.—As soon as the weather will permit, the McQuay Tanning Co. intends to build a large addition to its plant, in order to accommodate its increasing business. The additions will include a leach house 35 by 110 feet, and a new vat house 30 by 40 feet, and three storeys high. Improvements will also be made to the boiler and power plant. The changes will involve an expenditure of about $15,000.

Vancouver, B.C.—It is stated that Lever Brothers have purchased a 21-years' lease of land on Burrard Inlet, with an option of renewing the lease for another 21 years, and that they were ready to spend over $200,000 there at once on factory, buildings and machinery; but the Harbor Board will not give Lever Brothers a waterfront lease for a longer period than five years, which the firm did not consider was long enough to warrant the expenditure proposed. The project is, therefore, being held up.

Regina, Sask.—A company of Regina business men has been organized for the purpose of developing the extensive fields of lignite coal in the southern part of Saskatchewan. The Government of the province has been carrying on experimental work in connection with the lignite coal for some months past, and it is as a result of these tests that the Regina company has been organized. The reports previously submitted dealing with the quantities of lignite coal in the southern part of Saskatchewan show that there is practically no limit to the supply. A method of briquetting the lignite coal has been devised and it is claimed that this will result in a saving in fuel of from 40 to 50 per cent.

Tenders

Port Alberni, B.C.—Tenders will be called for the supply of a quantity of 10-in. and 12-in. steel pipe, also wooden staves for the 16-in. water main.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, City Hall, up to Tuesday, April 13, 1915, for the supply of automatic valves and check valves. Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, City Hall, up to Tuesday, Feb. 16th, 1915, for the construction and delivery of 24-in., 30-in. and 36-in. cast iron special castings. Specifications and tender forms for the foregoing may be obtained upon application at the office of the Water Main Extension Section, Department of Works, Room No. 9, City Hall.

Toronto, Ont.—Tenders will be received, addressed to the chairman of the Board of Control, City Hall, up to Tuesday, March 2nd, 1915, for the construction and delivery of 24-in., 30-in. and 36-in. stop valves, and one 36-in. check valve. Specifications and tender forms may be obtained upon application at the office of the Water Main Extension Section, Department of Works, Room No. 9, City Hall.

Ottawa, Ont.—Tenders will be received until Monday, March 1st, 1915, for the supply of brooms and brushes, chain, hardware, hose, oils and greases, packing, paint, paint oils, etc.; Manila rope, wire rope, and steam pipe, valves and fittings, for the departmental dredging plant in Ontario and Quebec. Combined specification and form of tender can be obtained at the Department of Public Works. R. C. Desrochers, secretary.

Ottawa, Ont.—Tenders will be received by the Secretary of the Waterworks committee up to Tuesday, February 23, 1915, for the supply and delivery of brasswork, special pipe castings, cast iron pipe, lead pipe and pig lead, valves, oils and greases as the case may be. Specifications, form of tender and full particulars may be obtained on application at the City Engineer's Office, City Hall, Ottawa. R. L. Haycock, Acting Waterworks Engineer.

Saanich, B.C.—Tenders will be received by the undersigned at the Municipal Hall, Royal Oak, Saanich, B.C., up to March 12, for the supply of materials, including cast iron pipes and special castings, valves and hydrants. Specifications, schedules of quantities and particulars may be obtained from the municipal engineer's office, upon making a deposit of $25, which will be returned on receipt of bona fide tenders. Hector S. Cowper, clerk, Municipal Council.

Ottawa, Ont.—Tenders will be received at this office until Wednesday, Feb. 24, 1915, for the installation of one (1) standard passenger and two (2) standard freight elevators in the examinging warehouse, Port Arthur, Ont. Plans, specification and form of contract can be seen and forms of tender obtained on application at the offices of Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont, from William Hood, architect, Port Arthur, Ont., and R. C. Desrochers, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received up to February the 26th for 1,000 sets of the undermentioned accoutrements, half quantity for delivery to H.M.C. Dock Yard, Halifax, and half to H.M.C. Dock Yard, Esquimalt, B.C.: Belts, waist (leather); bags, ammunition (leather); bandoliers (leather), braces (leather), water bottle slings (leather); holsters, pistol (leather); pouches, cartridge pistol (leather); mess tins and covers, canvas; haversack, canvas; water bottle, enamelware (with felt cover). Patterns may be seen, and tender forms with full information may be obtained on application to the undersigned and to the Naval Store Officers, H. M. C. Dockyards, Halifax, N.S., and Esquimalt, B.C. G. J. Desbarats, Deputy Minister of the Naval Service, Department of the Naval Service, Ottawa.

Trade Gossip

The John S. Metcalf Co., of Montreal, is now completing elevator No. 2, for the Manchester Ship Canal Co., at a cost of $900,000.

Warren, Ont.—A local chemical manufacturing concern has started work on a large order of guncotton for the British Government.

Saskatoon, Sask.—G. Field and Harry Wells have established a plant in the McEown Building, under the name of the Western Tent and Mattress Co., for manufacturing tents, awnings, etc.

Toronto, Ont. — The York County Council are considering the purchase of a supply of rifles of an approved type for the use of the members of the different Home Guard organizations throughout the country.

New Glasgow, N.S.—At a meeting of the board of directors of the Nova Scotia Steel and Coal Co. it was decided to restore to the men the 25 per cent. wage cut which they received in July last at the outbreak of the war.

U. S. Copper Shipments.—Copper exports from the United States amounted to 15,389,322 pounds, valued at $2,067,356 during the week ended January 30. Of this 6,289,648 pounds went to France, 4,776,728 to England, 1,717,428 to Italy, 1,456,336 to Sweden and 691,142 to Canada.

Port Alberni, B.C.—Officers for the year were elected by the Board of Trade as follows:—President, A. Sproat (re-elected); vice-president, S. G. Roseborough; secretary, W. S. Barton; treasurer, T. W. Trew; executive council, E. S. V. McClintock, W. A. Stevens, I. C. Lewis, C. A. McNaughton, F. W. Doherty.

Arnprior, Ont.—A new industry has been organized here recently under the name of the Arnprior Manufacturing Co. They will manufacture jersey and canvas gloves and mittens. The officers of the company are:—President, A. Stevenson; vice-president, J. S. Phillips; secretary-treasurer, C. E. Bremner; manager, A. Bremner.

Oshawa, Ont.—The Board of Trade met on Feb. 2 and elected the following officers for the ensuing year: Col. J. F. Grierson, pres.; J. W. Provan, vice-pres.; D. A. J. Swanson, sec'y-treas.; Board of Trade council, the above officers and Messrs. H. B. Samuels, Jno. Stacey, W. L. Law, T. B. Mitchell, J. P. Hennessy, J. F. Tamblyn, A. S. McLeese.

Red Deer, Alta.—At a meeting of the Board of Trade held recently, the following officers were elected:—President, R. B. Welliver; vice-president, T. A. Gaetz; council, Dr. Collison, W. E. Lord, S .N. Carscallen, John Malcolm, H. H. Gaetz, John McLennan, F. W. Galbraith, G. W. Smith, H. H. Humber, Harry Wallace.

Kenora, Ont.—The annual general meeting of the Board of Trade was held here last week. The election of officers for the present year resulted as fallows: President, Major Schnarr; vice-president, M. K. Heap; secretary-treasurer, R. J. Moore; council of the board, J. P. Earngey, W. G. Cameron, George Drewry, J. T. Brett, D. McLeod, A. Shragge, Thos. Walsh and Geo. A. Beatty.

Collingwood, Ont.—At the annual meeting of the Board of Trade, held on February 1, officers were elected as follows:—President, D. L. Darroch; vice-president, J. F. Zimmerman; secretary, C. L. Stephens; treasurer, David Wil-

liams; councillors, J. M. Smith, F. W. Bryan, W. A. Hogg, F. F. Telfer, G. C. Begg, W. R. Patterson, M. P. Byrnes, W. A. Copeland, H. A. Currie, F. A. Hodgson.

Owen Sound, Ont.—The following officers have been elected by the Board of Trade:—J. K. McLauchlin, president; Elias Lemon, vice-president; and George Menzies, secretary. The members of the council of the board are: John Parker, W. R. Chester, William Taylor, J. M. Kilbourn, F. W. Harrison, C. A. Fleming, W. H. Smith, T. W. Douglas, J. R. Wainwright, L. L. Dales. E. W. Harrison was elected the representative of the board in the municipal council for 1915.

Ottawa, Ont.—A delegation from Southern Alberta met the Government on Feb. 1 and asked that five million dollars be spent in continuing public works and irrigation schemes in that Province, especially in the Lethbridge district. The particular object is that of relieving the problems of unemployment. The delegation, which comprised the mayors of Calgary, Lethbridge, and Medicine Hat, got an assurance of consideration of their proposals.

Exports Prohibited.—An Order-in-Council has been passed at Ottawa prohibiting the export of tinned meats and tinned plates to Sweden, Denmark and the Netherlands. An embargo has been placed also upon the export of tea, clover, grass seeds and motor vehicles to all foreign ports in Europe, and to Mediteranean and Black Sea ports, except France, Russia, Belgium, Spain and Portugal. Aniline oil and salt and certain acids used in tanning, explosives of all kinds, ships, floating docks, whale oils must not be exported to any but British countries.

National Clay Products Association.—The annual convention of the Canadian National Clay Products Association was held recently in the King Edward Hotel, Toronto. Almost 100 delegates were in attendance from various parts of the Dominion, while a number of prominent clay manufacturers from the United States were also present. The association was officially welcomed on behalf of the city by Mayor Russell, M.P.P. President Charles A. Millar, in opening the convention, spoke in an optimistic tone.

Toronto, Ont.—The Toronto Board of Harbor Commissioners, during the last six weeks, has received twelve applications from United States firms in regard to the new water front area. Previous to the period from August on to December there was a complete cessation of interest in the new industrial area under creation and the recent activity in the industrial field. The area for industries in the Ashbridge Bay district is assuming shape and the commission is in a position to deal with all applications. About a thousand men will be given employment when the harbor development work is resumed next April.

Big Orders for Lumber.—The latest section of Canadian business to benefit by the purchase of supplies for the British Government is the lumber trade. Frederick Stobart, British War Office representative, states resently that he has placed large orders with British Columbia firms for lumber to be used in the form of railroad ties and bridge timbers. The purchase of this material would appear to justify the belief that the British Government is planning to construct certain military railway lines, and, if this is so, it is not unlikely that other manufacturers of construction materials, as well as manufacturers of rolling stock and locomotives, may receive some orders from the same source.

U. S. Exports of Copper.—Copper exports from the United States for the week ended January 23 amounted to $3,050,601, or $2,011,580 more than was shown for the preceding week, ended January 16, according to reports from the ten principal Customs districts by the Department of Commerce. The total export last week was 23,057,055 pounds, against 7,836,759 the preceding week. France was the principal purchaser of copper from United States markets last week, 14,927,323 pounds being transported there. Italy was second with 4,114,324 pounds and England was third with 3,489,437. During the eight weeks ended January 23, 93.396,426 pounds of copper, worth $12,001,006, were exported.

Toronto, Ont.—This city's share in Federal appropriations, announced at Ottawa last Monday night, includes in the new votes $1,000,000 for harbor improvements, $15,000 for the fish exhibit at the Canadian National Exposition, and $12,000 additional for the Dominion buildings, for which $225,000 is revoted. Other revotes are $213,000 for military buildings, and $74,000 for Spadina Avenue postal station.

C. M. C. New Financing.—The Canada Machinery Corporation, Ltd., has called a meeting for February 18 in Galt, at which the first mortgage bondholders will receive a new proposition regarding their holdings, upon which a full year's interest of 6 per cent. is now in arrears. It is proposed to pay the past due interest, and also the accruing interest for 1915 and 1916, by issuing second preferred stock, ranking subsequent to the first preferred stock issue. The bondholders will also be asked to exchange one-half their holding of bonds for first preferred stock, ranking with the present issue outstanding, and to consent to the placing of a prior lien mortgage on the company's properties in Hamilton, the proceeds to be applied toward additions and extensions of the fixed assets in Galt. If the mortgage is not placed permission will be sought to sell the property.

The Abitibi Pulp & Paper Co. is making good headway in the completion of its new plant at Iroquois Falls, Ont. At present 200 tons of pulp a day are being manufactured and all the structures in connection with both the pulp and paper mill have been completed. The machinery for two paper machines is now assembled and it is expected that these will be in operation not later than April 15. Another machine is expected to be installed by July 15, and a fourth in early September. The combined daily capacity of the plants, when the four paper machines are in operation, will be 250 tons of newsprint, 250 tons of pulp and 75 tons of sulphite. All of the pulp and 50 tons of the sulphite will be used in the manufacture of the newsprint. The surplus 25 tons of sulphite will be sold. Over four-fifths of the company's paper, it is announced, will be shipped to American firms.

Pulp Mills Busy.—Sixty-four pulp mills in Canada report a total consumption, in 1913, of 1,109,034 cords of pulpwood. Nearly an equal amount was exported to the United States in an unmanufactured condition. Thus, for the first time in the history of the industry, more than half of the pulpwood produced in Canada was manufactured into pulp in Canadian pulp-mills. Quebec leads in the consumption of pulpwood, followed, in the order named, by Ontario, British Columbia, New Brunswick and Nova Scotia. As the pulp industry on the Pacific coast is still in its infancy, steady increase in British Columbia may be expected. Over two-thirds of the wood used for pulp was spruce, and one-fourth balsam fir. The percentage of fir used has grown steadily, as the prejudice against this wood has been overcome. Jack-pine is also beginning to be a factor, though still a small one, less than 20,000 cords being reported as manufactured in 1913.

Calgary Exports to U.S.—A large increase in the exports to the United States from Calgary is shown in statistics just prepared for 1914 by the United States Consul there. From this report it appears that the exports for 1914 totaled in value $4,712,191 and exceeded the exports of the previous year by 350 per cent. In practically every branch of agricultural activity there has been greatly increased production in this dis-

Relative to Cam Grinding and Cam Grinding Equipment--IV.

By Howard W. Dunbar.

The purpose of this series of articles is to describe as clearly as possible the methods employed by the Norton Grinding Co., Worcester, Mass., in the production of the master cams which are used for cam grinding. There are doubtless many of our readers whose knowledge of the subject will be materially increased thereby. Text and cuts, courtesy Norton Co.

THE rapid change in the design and improvement in gas engines from the earlier types of a single cylinder to the present-day modern engine of

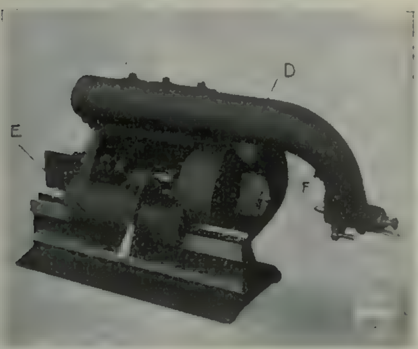


FIG. 1. FRONT VIEW NO. 2. LOOSE CAM ATTACHMENT.

four, six and even eight cylinders has called for a corresponding change in grinding equipment so that to-day to meet the needs of gas engine manufacturers in accurately and rapidly producing hardened steel cams, grinding attachments are manufactured by the Norton Grinding Co., of a loose cam type in four sizes and of an integral type in two sizes with two methods of driving. These attachments are equally good, however, for the production of any style of peripheral cam or irregular shapes within their capacities. They not only finish grind the hardened cam but are also capable of economically roughing out the shape from a forging, and in most cases even from a cylindrical piece of stock.

Loose Cam Attachments.

All the loose cam attachments are of the same general design and operation, differing only in their mechanical construction, dimensions and capacity, and because we will treat in detail later the more widely used integral attachment, the principles of operation of which are identical with the loose cam attachment, but a brief description is here given.

Figs. 1 and 2 show the No. 2 Loose Cam Attachment front and rear view as it appears on the machine. Motion is transmitted to the attachment by the headstock through the crank at A. The hardened master cam which produces the desired shape on the cam blank is mounted at B, and the attachment oscillates on the trunions C. The work to be ground is mounted on the centres, and is supported by the overhanging arm D. Rigidity and wear are big factors in the accuracy of the work produced, so here we see a fixture with weight, strength and stability, with large and accurately made bearings. Means are provided for lifting the work away from the grinding wheel by lever E. The cam is driven by dog. F, the proper speeds being obtained through the regular speed change mechanism in the head stock.

The several attachments have a capacity in swing of 1⅝ in. 2⅞ in., 5 in. and 7 in., and in lift of ¾ in., 1⅜ in., 1½ in. and 3 in. (see Fig. 3), and are adapted for use on the 6 in., 10 in., 14 in. and larger machines.

Integral Cam Attachment.

The advent of the forged cam shaft having a number of cams integral with the shaft made necessary the development of a fixture to grind these cams, and so the integral cam grinding attach-

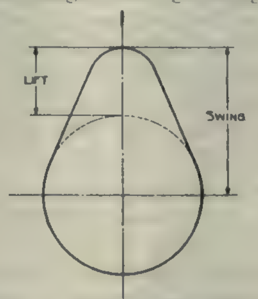


FIG. 3. LIFT AND SWING DIAGRAM.

ment was designed taking its name from the style of cam shaft it was to handle. Two types and two sizes are manufactured, the two types differing only in the method of driving—one getting its power through the headstock of the ma-

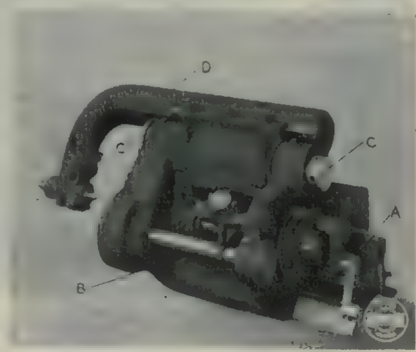


FIG. 2. REAR VIEW NO. 2. LOOSE CAM ATTACHMENT.

chine, while the other is belted direct from overhead. Both have their advantages.

Where a variety of work is to be done the first is recommended, as it is possible by simply removing the attachment from the table of the machine to be ready to handle any form of cylindrical grinding, while in the latter the head and footstock of the machine are omitted and the attachment occupies the entire table surface (making possible a shorter machine), and is confined to the grinding of cam-shafts where large quantities are required. In size the attachments are capable of swinging 2 in. and

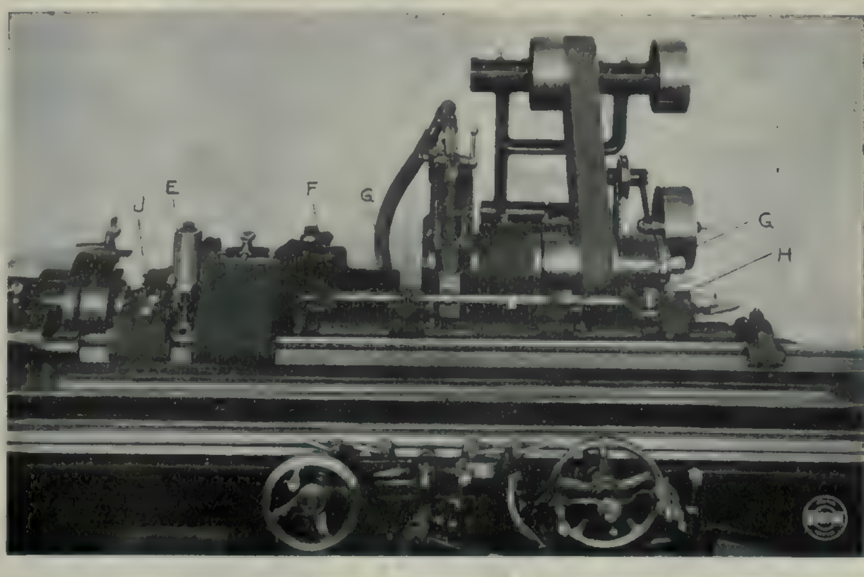


FIG. 4. ATTACHMENT ON MACHINE IN OPERATING POSITION.

2 3-16 in., with a lift of 7-16 in. and ¾ in. (see Fig. 3), and will handle cam-shafts up to 58 in. over-all length, having from one to fourteen cams to be ground. They are adapted for use on 10 in., 14 in. and larger machines.

The greatest length shaft that an attachment will handle is determined by the length of the machine. However, attachments to handle shafts longer than 58 in. are not recommended, because even though the attachment is stiff, and strong enough to prevent twisting, the cam-shaft in itself is inherently so weak that in grinding the cam farthest removed from the drive there is a spring that would make it impossible to grind all cams within the degree of accuracy generally required.

Fig. 4 shows the attachment on the machine in operating position. Fig. 5 is a nearer view of the rear of the headstock end of the attachment, on which A is the driving arm; B the master cams on the master cam spindle, and C the roll which is quickly located before the proper cam by sliding along shaft D as illustrated in detail by Fig. 6. The spring encased, which holds the master cam snugly against the roll is shown at E, while F shows the driving dog in position, G the steady rests, and H the footstock, which is movable to allow for different lengths of cam shafts, which are carried on the centres of the attachment. As the master cams revolve and bear against the roll, the attachment oscillates about the centres X in Fig. 7, which shows the end view in detail of the attachment.

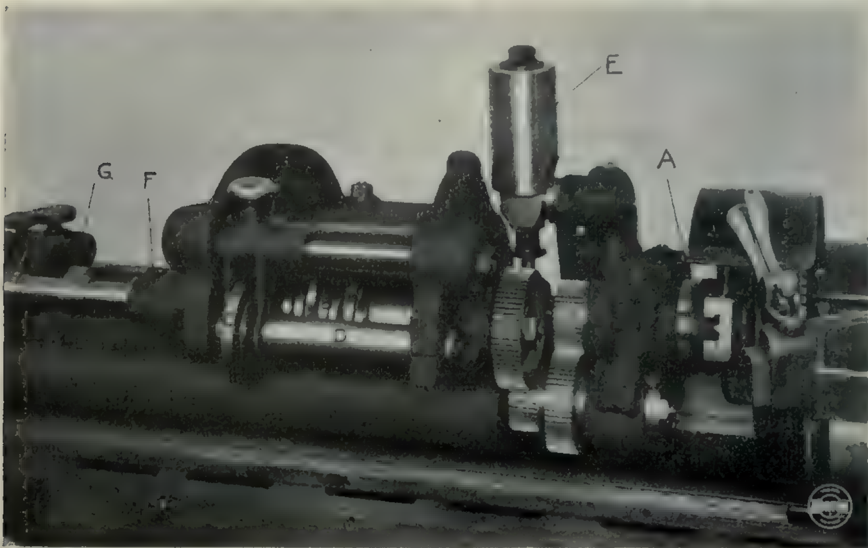


FIG. 5. NEAR VIEW OF REAR OF HEADSTOCK END OF ATTACHMENT.

The wheel is fed into the work with the wheel feed index by the operator gradually bringing it in until the desired shapes are produced; handle J being provided to lift the work away from the wheel when it is desired to inspect during the process of grinding, or to move the roll from one position to another.

Let us assume that we have a four-cylinder cam-shaft to grind, then in addition to the machine and attachment, the following equipment is necessary:

One driving-dog for roughing and finishing.

Two steady rests (number varies under different conditions).

Two work shoes for roughing.

Two work shoes for finishing.

One set of master cams on spindle.

Dogs.

Fig. 8 illustrates the type of dog generally used for roughing and finishing. In assembling on the shaft, care must be exercised to see that it bears the proper relation to the cam to be ground. This is taken care of by the keyway shown. It is most important that no lost motion take place between the driver and the shaft, and to provide against this and also for any wear which is liable to appear, a clamp and set-screw are provided. It is self-evident that the dog is readily removed from the shaft.

Under some conditions, it is necessary to use a roughing dog. Notably among these is the flange type cam-shaft. On such a shaft we cannot use the type of dog illustrated, but must have a special one. All such cases are special and have to be treated individually.

Steady Rests.

Too much importance cannot be placed on the question of steady-resting, as on it depends much of the accuracy of the product. Much thought should be given to the number required (depending upon the length and slimness of the shaft) and the proper place to locate them with reference to the points to be ground.

There are two general types used—the open and the closed—shown in Fig. 9.

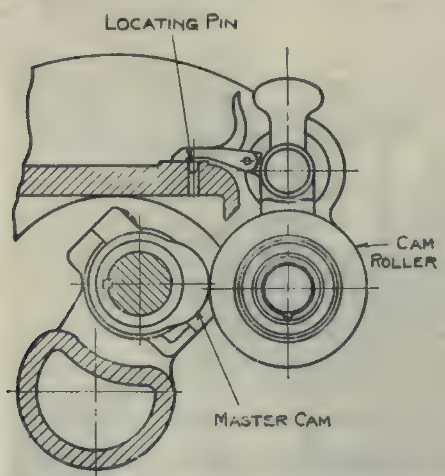


FIG. 6. SHOWING MASTER CAM, LOCATING PIN, AND CAM ROLLER.

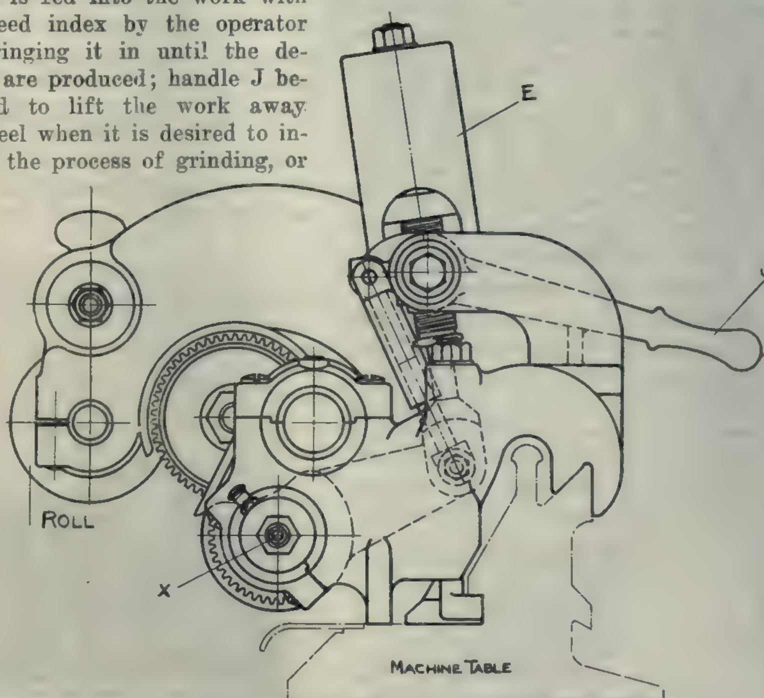


FIG. 7. END VIEW OF ATTACHMENT IN DETAIL.

The open type has the advantage of being more easily handled in putting in and taking out the work, and gives very satisfactory results, and where a degree of accuracy is required, bordering on perfection, the closed type is recommended, and is generally used on the

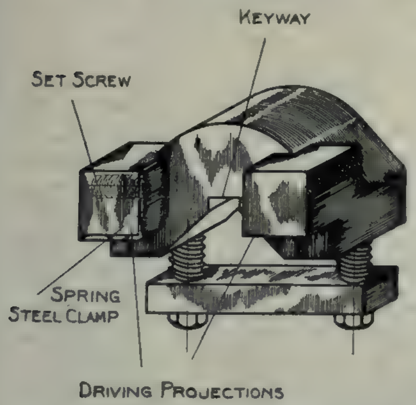


FIG. 8. TYPE OF DOG USED FOR ROUGHING AND FINISHING.

same bearings used in the engine. Of course, it is obvious that with this goes a greater time required in handling. Hardened steel work-shoes are shown at A and the adjusting screws at B, element C being adjustable in and out and up and down.

Work-Shoes.

Ordinarily, hardened steel work-shoes are supplied, but in some special cases it is necessary to use bronze. The shape generally used is shown in Fig. 10. It is important that the bearing point A be diametrically opposite the grinding wheel to take the pressure in that direction, and that the point B be on the opposite side of the vertical centre line to support the shaft and steady it in the direction of rotation of the wheel. As the shaft comes to the grinding machine it is generally roughed out and left a little over size to allow for hardening, spots always being provided for the work-shoes to bear on. The cams are then roughed to their approximate contour, leaving them slightly over size, after which the shaft is hardened and the bearings ground to size in a machine using regular equipment. We are then ready to finish grind the cams, using the finishing shoes which are the exact size of the bearings on the cam-shaft.

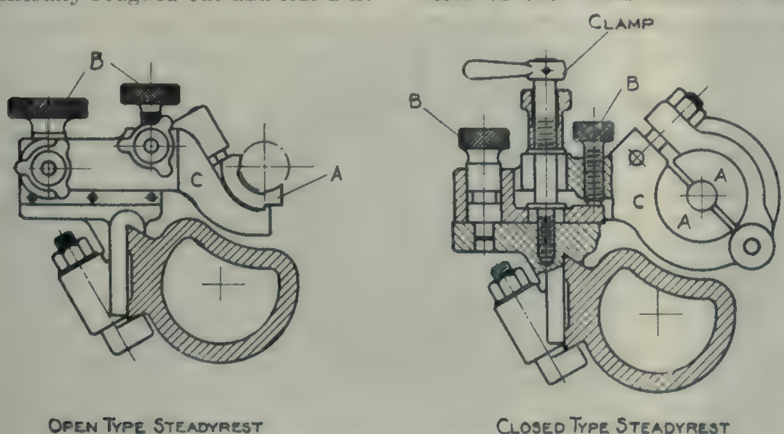


FIG. 9. GENERAL TYPES OF STEADY REST.

Cam Grinding Wheels.

The wheels used in grinding cams depend upon many things—the accuracy required, the finish, the operator, the machine and the material the cams are made from, but as it is not the purpose of this article to discuss wheels, the subject will be treated but briefly. It is important that the wheel should always be 18 in. in diameter (except on the No. 1 loose cam grinding attachment, when it is 14 in. diameter), the width of face depending upon the width of cams to be ground, and any projection on shaft that might interfere with the wheel.

Variations from 18 in. in diameter will produce results as in Fig. 11 (exaggerated to illustrate the principle), showing that with a wheel larger in diameter than 18 in. a convex faced cam will result, and with a smaller diameter wheel a concave faced cam. It will be apparent, therefore, that the nearer 18 in. in diameter, the nearer perfection; and the same amount of wear allowable is dependent on the variation in contour permissible. One inch worn from the diameter of the wheel does not affect the lift or opening points appreciably, but it is true that by any practical known method of cam grinding a change in the diameter of the wheel, be it ever so small, changes the contour of the cam.

FIG. 10. WORK SHOE FEATURE.

A medium soft wheel is best suited for this work as being capable of greater production and accuracy, presenting a truer surface. As a general rule the wheel should revolve at approximately 6,500 s.f.p.m. For roughing the work, speed is not so important, and can be run moderately fast around 40 to 60 r.p.m., but, for finishing, considerably lower speed should be used, say about 15 to 20 r.p.m. These speeds, however, are best determined in each individual case by trial, and depend upon the degree of accuracy required and the kind of wheel being used. The speeds given only apply to the grinding of integral cams.

The size of the cams and conditions in the loose cam grinding attachment vary with each case, so no definite information pertaining to speeds can be given. It is common practice to run the work much faster than the speed mentioned, and in addition use a hard wheel, but if genuine accuracy is required, such methods cannot be followed.

Important Suggestions.

The centres in the cam-shaft should always be as large as is consistent with

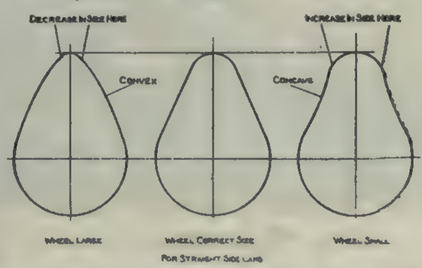


FIG. 11. WHEEL DIAMETER EFFECT DIAGRAM.

its size, and as perfect as possible, as no work will be more accurate than the centres are. The centres in the attachment should be kept clean and well lubricated, and it goes without saying that they must be kept absolutely concentric. There have been many cases where this was not observed, and complaint made that the master cams were not correct.

Care should always be taken to see that everything is properly oiled. Do not put oil on the master cams or the roll surface as it collects dust and will produce inaccurate work. Always keep everything clean; never leave the machine without cleaning thoroughly all parts of the attachment.

Bear in mind that each individual master is made for a special cam on the cam-shaft, and that by the system of marking the master cams, the holes in the attachment have the same numbers as the masters. No. 1 master makes cam on the extreme right-hand end of the cam-shaft as placed in the machine, No. 2 the next to the left, No. 3 the next, and so on.

Be sure that the attachment is securely fastened to the table of the machine;

rigidity means accuracy. True the wheel frequently enough to have a good true surface. Generous use of the diamond brings satisfactory results; anything but an absolutely true cylindrical shaped wheel will not give perfect work. Be sure that steady rests are securely fastened in place and are steady rests, and the work shoes have a good bearing on the work.

Let plenty of compound flow on the work and wheel while grinding. It not only lubricates but carries away the heat generated, thereby keeping the work at a uniform temperature. Changes in temperature mean changes in the correctness of the product.

The foregoing suggestions may seem fussy, far-fetched and unnecessary, but stop to think we are dealing with dimensions by tens of thousandths which are scarcely measureable. The production of cams is a refinement in itself and must of necessity have refined equipment. It is effort wasted for anyone to attempt to produce cams accurately by a rough and hustling method. Cam-shafts of a medium and indifferent quality have been produced by a rapid work revolution, hard wheel and a forcing policy, but no one should criticize the master cams, attachments or machine, if such practices are followed.

TEST OF DRILLS FOR CAST IRON.

By A. W. Brayshay.

THE following tests were made to obtain a standard to compare drills offered by different makers and by which improvements in drills might be readily noted. The tests were made under working conditions as to materials, feeds and speeds. Testing to destruction does not necessarily show the best drill, and much information of value for regular work is lost where the ordinary routine is departed from. Undoubtedly the most valuable test is that under ordinary working conditions when very carefully, accurately and fully noted.

The tests were made on a new central thrust 4 ft. 6 in. radial machine of ample power and rigidity. The castings drilled were of the same design, size, weight and thickness. The metal varied not more than might be expected in any twenty or thirty castings, each weighing about 1,120 lb. Two drills from each of two makers of repute were taken, and the following particulars are of the drills before testing:

Drill	No. 1	No. 2	No. 3	No. 4
Maker	X	X	Z	Z
Diameter	1⅛ in.	1⅛ in.	1⅛ in.	1⅛ in.
Price net	10s. 10d.	10s. 10d.	10s. 4d.	10s. 4d.
Total length new	12 in.	12 in.	11¾ in.	11⅞ in.
Length from shoulder	7 11-16 in.	7⅝ in.	7 3-16 in.	7 3-16 in.
Weight new, grammes	879.4	851.9	879.8	874.5
After first test—				
Weight after grinding	878.4	850.9	878.8	873.8

The following particulars did not vary throughout the test:

	Light	Loaded
Amperes	12	20-25
Revolutions	200	192
Feed per minute, 1⅛ dia.	58.9	56.54
Feeds per inch	48	48
Feed per minute, inches	4.167	4

Distance through holes, 1¼ in.
Time per hole, 20-22 seconds.

First Test.

	No. 1	No. 2	No. 3	No. 4
Number of holes before failure	162	128	212	48
Weight of drillings in pounds	53¼	41¼	71	16¾
Analysis of drillings, Si	2.20	2.44	2.42	2.26
S	0.075	0.066	0.084	0.065
Sclerescopic hardness, each result the average of twenty tests	45.5	45.4	48.5	46.65

Second Test After Re-grinding.

	No. 1	No. 2	No. 3	No. 4
Number of holes before failure	100	50	144	35
Weight of drillings in pounds	39	20¾	56¾	13¼
Analysis of drillings, Si	2.38	2.49	2.53	2.39
S	0.071	0.071	0.060	0.065
Sclerescopic hardness, each result the average of twenty tests	48.2	51.55	45.75	47.2

First Test.

Amperes.	No. 1	No. 2	No. 3	No. 4
1st hole	20	22	22	20
50th hole	20	23	23	..
100th hole	22	24	24	..
150th hole	22	..	23	..
200th hole	..	..	24	..

Second Test.

Amperes.	No. 1	No. 2	No. 3	No. 4
1st hole	22	22	22	22
50th hole	24	25	23	..
100th hole	25	..	24	..

Note—Amperes and volts (240 D.C.) : 746= horse-power consumed.

In every case the drill was ready for re-grinding at 25 amperes, and the amount of drill ground away was about .01 in. Drills Nos. 1 and 2 have the advantage of 7-16 in. length from the shoulder, which would allow them to be reground several times more than Nos. 3 and 4. Drill No. 3 showed splendid results, but they were more than balanced by the failure of No. 4 by the same maker.

Taking the various factors carefully into consideration, the results show drills Nos. 1 and 2 to be more regular and consistent, and as samples to give better promise of the quantity than Nos. 2 and 3. As a standard by which to compare drills, 1⅛ in. diameter 150 holes, 1¼ in. deep, at 192 revolutions, 4 in. feed, in average cast iron may be accepted.—The Engineer.

ADJUSTING MEN TO CONDITIONS.

IN a contribution to the current month's issue of "System," entitled "Adjusting Men to Conditions," F. R. Hazard, president the Solvay Process Co., epitomises the human side of shop management as follows:

Men who fall down on their jobs are not necessarily drones. Three causes not entirely of their own making may be behind their apparent incompetency.

First, they may be round pegs in square holes. That the man and the job must fit is an old story. Still, how many of us list the job's requirements and the man's abilities before we pass judgment?

Secondly, jealousies may have taken all the attractiveness out of the work. A foreman, for instance, may not have been big enough to train up somebody for his job. The men under him see that he is afraid to risk his own pay envelope and so the men lose the incentive they deserve.

Thirdly, an unhealthy spirit may have spread dry rot and stagnation through the entire organization until the best men are the first to become disheartened. There must be a healthy esprit de corps if a business is to swing ahead into its fullest opportunities.

Each one of these causes, and others about as self-evident, must be taken into account before a man is written down a drone.

We say that a manager "works well with men" when he makes these everyday adjustments that give the best answer we know how to get to the human equation problem. They do not usually come "just natural" to a manager, I think. He may use them almost as a matter of second nature, but he knows that he is using them.

The wise manager has an understudy for each position above a certain point, but below that point, in a large proportion of the vacancies, men must be trained when gaps occur. Not every business man sees that the cost of this training is very real. Here in our business we find that it costs anywhere from $50 to $200 to train each new man.

German Shrapnel.—In an ordinary shrapnel shell the interstices between the bullets are filled with melted resin or other gum compound, but the German shrapnel shell presents special features. In it the resin is replaced by a high explosive, usually T.N.T. The fuse is so arranged that the shell may act as a time shell or an impact shell, and there is added to the fuse a delay action so that the shell if required may burst a considerable time after impact.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

DEVICES FOR FINISHING SPHERICAL SURFACES.

By Avery E. Granville.

IN our February 11 issue, the devices and attachments employed in turning the end of a ball lever, and for ball grinding, were described and illustrated.

Turning Larger Spherical Surfaces.

Another device intended for turning larger and heavier work than previously

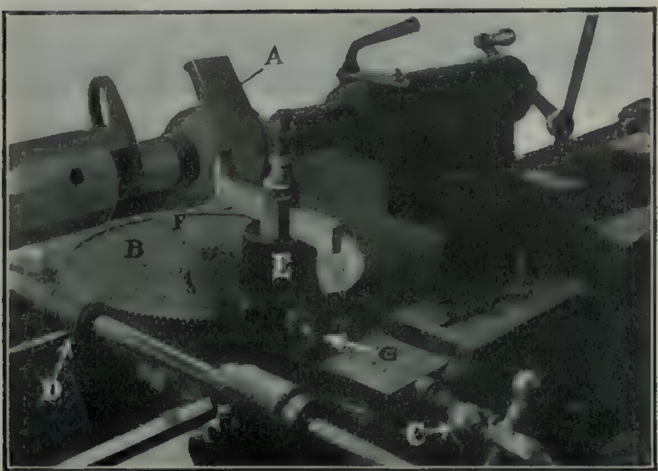


FIG. 5. A ROTARY TURNING TABLE.

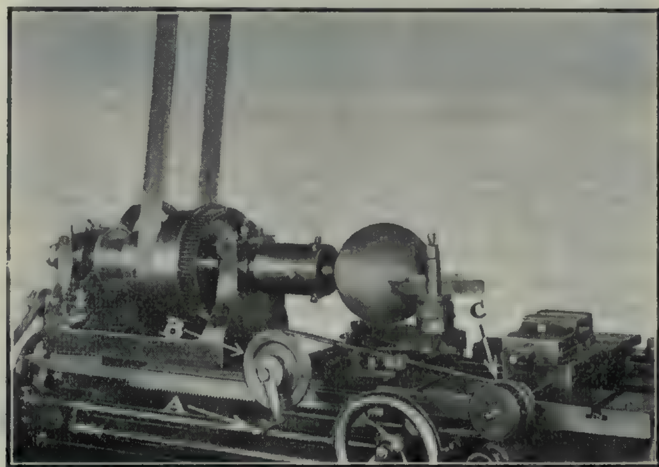


FIG. 6. BALL TURNER WITH POWER FEED.

described is shown in Fig. 5. The work is mounted between lathe centers, and the two surfaces on opposite sides of the piece A are turned so as to produce a truly spherical surface as the word is understood in the shop. The rotary movement is obtained by means of the large worm-gear B, which is centered on

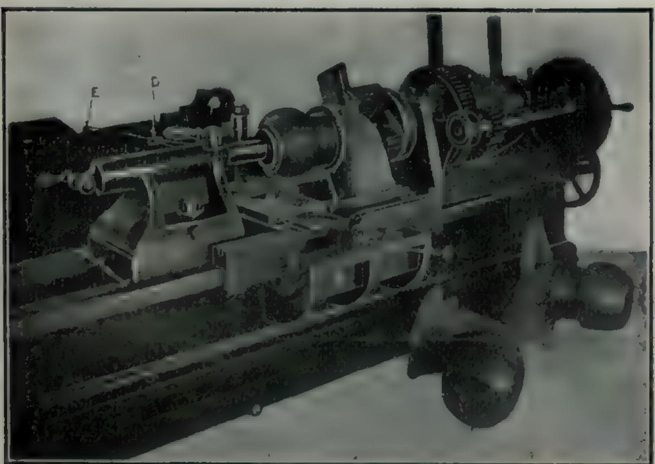


FIG. 7. A CAM ARRANGEMENT.

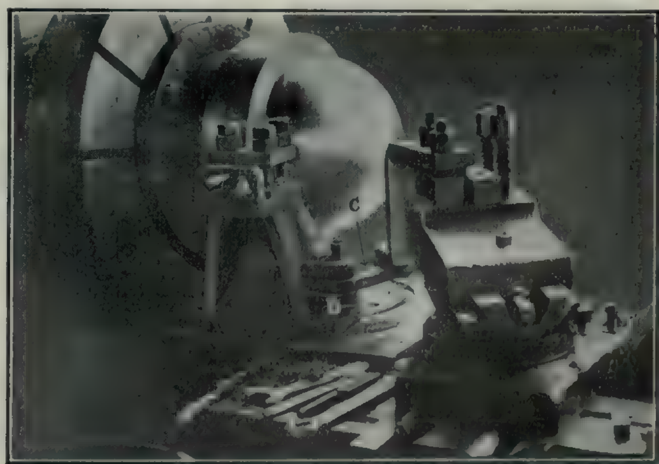


FIG. 8. TURNING A 10-INCH PINTLE.

the lathe cross-slide exactly under the ball to be generated. This worm-gear is turned by means of a ball crank C mounted on the same shaft as worm D which meshes with the gear. The entire mechanism may be run in or out by means of the regular cross-slide screw. The cutting tool is mounted in a block E set on a slide F on the worm gear, so that it may be set with relation to the centre by means of the adjusting screw G.

A device made on the same principle as the one just described, is shown in Fig. 6. This differs considerably in form however, and is also made to use either hand or power feed, the latter being made possible by the uninterrupted surface to be finished. The cutting tool is mounted and adjusted in about the same way, but besides the hand crank A which may be used at any time, there is a pulley B fastened to the worm-shaft. This pulley is belted to a pulley C, mounted in place of the cross-feed ball crank. With the tool properly set and the cut started, the cross-feed is thrown in, the pulley C starts to revolve, and from it the ball turning tool is gradually carried around the ball being turned.

A Cam Arrangement.

The device shown in Fig. 7 is useful where a true sphere is not required, or where the radius of the surface turned would make a rotary turner of awkward proportions. The forming or master cam, is placed at A. This is mounted on a bracket B bolted to the lathe bed. A follower pin C is carried in a heavy piece of bar attached to the tool carriage slide. The cross-feed screw is removed and the tool carriage held back by means of a weighted cord D, which runs over the pulley E. Traverse movement of the carriage is all that is necessary to produce the cut desired, so that power feed may be used if advisable. The tool itself may be fed out or in by means of the compound rest.

Turning Nickel Steel Pintles.

The work shown being turned in Fig. 8, is a nickel steel pintle for a Panama Canal gate, the spherical surface when finished, being 16 inches in diameter. The cutting tool is carried in the bracket A which is made of steel. This bracket travels in the groove B, being pulled around by the movement of the cross-slide to the compound rest of which it is attached by the link C. The operation of this device will be better understood by reference to Fig. 9, where the position of the parts at the end of the cut is shown. These pintles are made from huge forgings, large enough to form three pieces. These are roughed out in a lathe as shown in Fig. 10. After being turned to approximate shape, the pintles are parted and finished as shown. The last illustration shows a pintle just being parted from the other two, blocks of wood being placed under it to ease the drop.

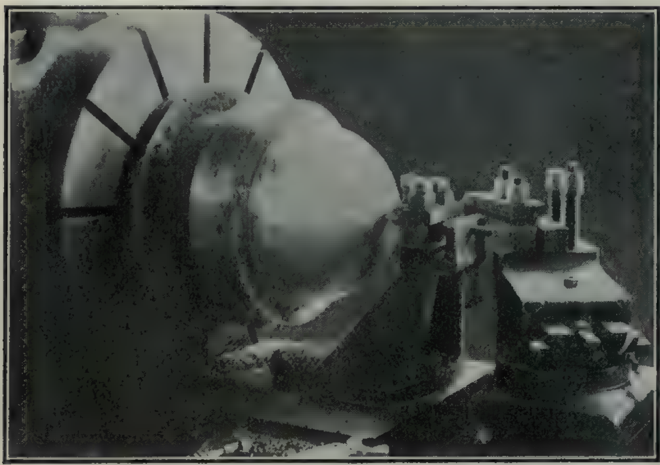


FIG. 9. POSITION OF PARTS AT END OF CUT.

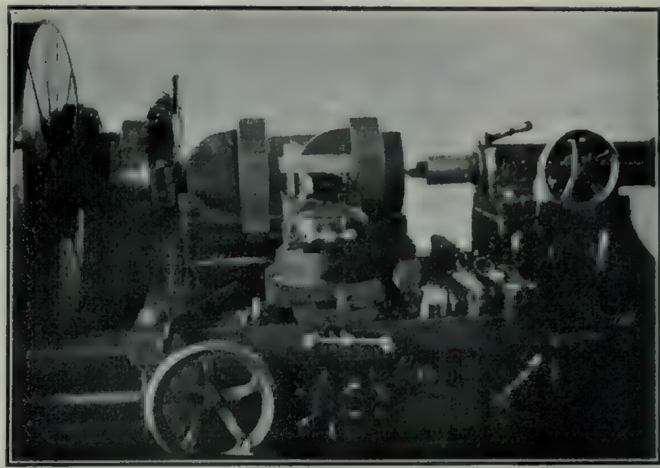


FIG. 10. ROUGHING OUT THE PINTLE.

PREVENTION OF SPARKING OF SMALL DYNAMOS.

By "Staveley."

WITH the increased use of dynamos and small direct current motors, the careful supervision of the commutator is an absolute necessity in the matters of economy and efficiency. Sparking at the brushes should not be tolerated, and the following suggestions will no doubt help in cases where the spark trouble is existing. Two conditions are necessary.

1.—The commutator must be in good condition.

2.—The brushes must be properly adjusted.

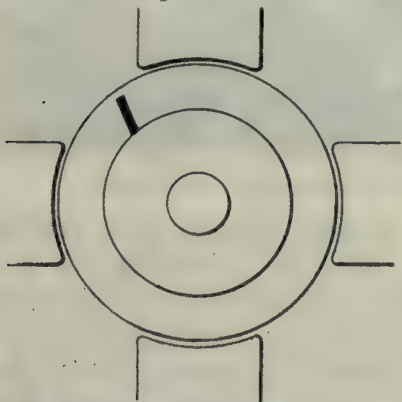


FIG. 1. ANGULAR POSITION OF BRUSH RELATIVE TO COMMUTATOR.

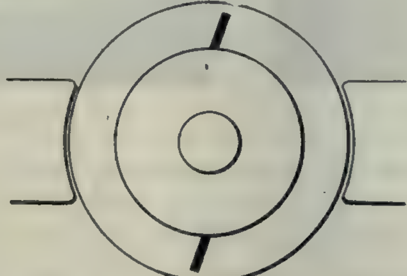


FIG. 2. POSITION OF BRUSHES FOR BI-POLAR MACHINE.

If the commutator is badly scored, or out of round, it should be taken to the lathe, trued up with very light cuts, and carefully polished with very fine emery cloth, all dust being carefully blown off. Smear the commutator with vaseline and then wipe off with dry duck, not with cotton waste. When the shaft has been replaced, all commutator connections should be examined to see that they are sound, and that the insulation is good.

The brush-holders can now be placed in position, having been previously cleaned and examined. The brushes should be inclined at an angle of about 60 degrees and the end of one brush should be wide enough to nearly cover two consecutive segments. There are several types of brushes now in use, but for many purposes a folded copper gauze brush is very suitable, it being light and flexible and, from necessity, must bear with light pressure on the commutator.

Now the position of the brushes is determined from the nature of the machine, that is, whether it be a two-pole-two-brush, four-pole-four-brush, or four-pole-two-brush. Suppose the commutator is made up of 80 segments, then mark one of these permanently as O. With a two-pole-two-brush machine, the positions of the brushes are primarily at 0 and 40, Fig. 2; with a four-pole-four-brush machine the positions are 0, 20, 40, and 60; and with a four-pole-two-brush machine the positions are 0 and 20, Figs. 3 and 4. These numbers can be marked

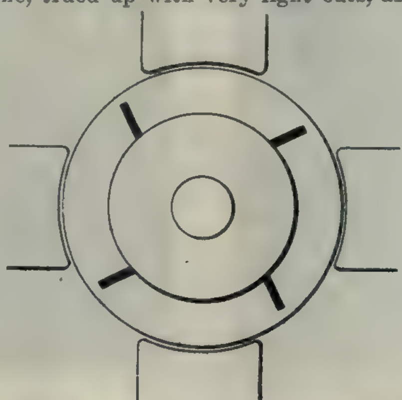


FIG. 3. FOUR-POLE FOUR-BRUSH ARRANGEMENT.

FIG. 4. BRUSH PLACING FOR FOUR-POLE TWO-BRUSH MACHINE.

(Continued on page 136.)

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

CONCERNING FOUNDRY COKE.

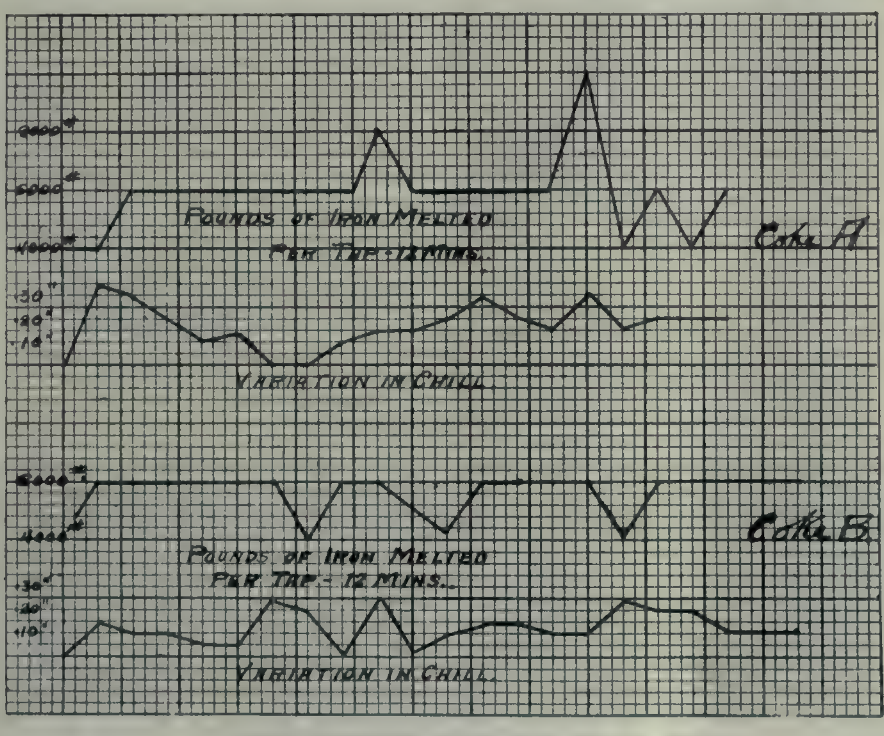
By "Melter."

COKE consists of carbon and ash with a small percentage of volatile matter, and is the residue from the expulsion of the large percentage of the latter from coal through the medium of heat. This volatile matter consists of hydrogen and oxygen, combined with each other and carbon, and is set free by the breaking up of the coal. Some of its compounds form gases and others when vaporised are condensed.

Coke Ovens.

There are several types of coke ovens, but here we shall consider only the beehive and by-product forms.

In the beehive oven, all the volatiles are burned in the same chamber adjacent to and above the coal. Heat is radiated from the top of chamber and, therefore, this allows some burning of the coke at the top.



COKE CONSTITUENT COMPARISON DIAGRAM.

In the by-product oven the volatiles are first taken away, then the tar and benzol are extracted by cooling, while the residual gases are returned and burnt in the flues around the oven; only as much hot air as is required being admitted. When the coal is coked, it is pushed out and quenched with water. In the beehive process, on the other hand, the whole oven is cooled which means that the next charge is heated up slower and proceeds slower. In the by-product oven, coal of high and low volatile constitution may be mixed to obtain best results.

The principal points to consider in choosing a coke for foundry purposes are:—Strength, density, melting rates, uniformity, sulphur, even taps, condition of cupola and ladles, height at which melting zone can be established and maintained.

Strength is necessary to resist breaking-up in handling—the waste being sometimes as high as 2%, and in crushing when throwing in the charge. If the coke be broken small, the amount of surface which is being burned is increased and, if the heat be not utilized as fast as produced, it is wasted.

Some founders make a shatter test by dropping 50 pounds of coke from a height of 6 feet, four times and, if the amount retained on a 2-inch screen be 80% or over, the coke is considered sufficiently strong. An authority whose name I cannot remember, gives the strength of beehive oven coke as 300 lbs. and by-product oven coke made from the same coal in each case as 940 lbs. per cubic inch.

Density determines the concentration of heat possible. For every quantity of heat there is a quantity of coke to be burned and air to be supplied and, to consume the fuel economically, there must be concentration. Heat is supplied by contact with the coke also by gases and contact of metal with other hot metal. If one coke is denser than the other, there will be less area in the denser for equal weights, and the concentration will be greater on the denser consequently, all other things being equal, a dense, strong coke is better than a light, weak one.

Uniformity in analysis and structure from day to day means that a foundryman does not have to be continually altering weight of iron charges or varying quantity of coke to correct irregularities. This is explained by the fact that hard coke requires more blast and soft coke less blast. If we have hard and soft coke in the same cupola, and are in the act of heating metal with the hard product, the soft coke above or adjacent will be burning due to the air blast not all being consumed but working up through the charge. When the next charge descends to the melting zone, there will be insufficient coke, which means more oxidation of silicon, manganese and carbon with resultant harder iron, also colder.

Sulphur is injurious to iron and when melting in a cupola, in most cases, iron will absorb it. A coke which is high in carbon and which melts iron quickly even though high in sulphur, may be more beneficial for use than a slow melting coke lower in sulphur and which keeps the iron in contact with it for a longer period and which forms a thick, sticky slag, more or less conducive to high sulphur iron.

In the illustration, H represents a high sulphur coke, while coke B contains just half as much sulphur. It will be noted in the first mentioned coke that the curve showing variation in chill is erratic, the normal chill being .15 ins. It will also be noted that, while coke A is a faster melting product, coke B melts more uniformly. Both these fuels are by-product and have a very similar analysis with the exception of the sulphur and ash feature. Coke B is claimed to produce less slag and to require less limestone. We would not, however, judge from the analyses that such would be the case, but rather the reverse. The fact, although not yet determined, may be due to greater uniformity of size and slower burning, thus not allowing the blast to sluff off the brick lining. Coke B shows high in phosphorus, but

this feature is watched so closely by manufacturers that no trouble is likely to result.

The A coke is hard, tough and much denser than B, their respective weights being 21 lbs. and 30 lbs. per cubic foot. Coke B, however, appears to have greater strength when incandescent, and requires less blast pressure for equal results, which may also be accounted for by the above-mentioned characteristics. To prove the contention that coke B was stronger when incandescent and did not burn away as rapidly in spite of its physical appearance when cold, the illustration shows consistently a softer chill. There was also hotter iron and a greater percentage left in the cupola after dropping bottom.

While the results obtained by using coke are largely a matter of product, it is often possible to vitiate these results by a poor understanding of the most ordinary laws governing combustion and general cupola practice:

	Coke A.	Coke B.
Carbon	91.05	90.00
Volatile combustible matter	3.65	1.30
Ash	5.50	8.50
Sulphur	1.00	0.50
B. T. U.	11,900	11,800

Ash Analysis.

Silica	38.97	50.33
Alumina	28.94	32.28
Iron Oxide	23.23	8.53
Lime	3.32	1.08
Magnesia	0.68	1.14
Phosphoric Acid	1.06	3.82
Sulphuric Anhydride	0.85	1.85

WAR SCRAP.

IN an article upon "War Scrap," in a recent issue of the Foundry Trade Journal, the author says that before very long there is no doubt that a large quantity of cast scrap iron and steel will be available.

In dealing with war scrap there is as a rule a fair bulk of unbroken shells as well as broken stuff of various kinds and, with the unbroken shells considerable care has to be taken, as there is always a risk of having one or more fully charged. Needless to say, a charged shell is a very dangerous thing to get into a cupola, because in the event of even a 3-in. or 75 mm. shell exploding, in all probability the cupola would be wrecked and other damage done, while the workmen would probably receive more or less injury.

For this reason all unbroken shells need special examination, and all those holding anything inside them, or which still are plugged at the charging end, must be laid on one side, either to be dealt with by someone who understands shells, or to be taken away by someone connected with the War Office. A communication to the latter will bring an inspector down pretty quickly where explosive war material is concerned—at least, that has been the writer's experience. The safest course, however, is to insist than only broken shells be sent by the iron merchant, as this places on him the responsibility of dealing with probably dangerous goods.

The Sorting-out Process.

It is not usual for copper, or copper alloy parts, to be sent out from the merchant's yard, owing to their value, but at times such metals do come out. In one case the writer got over 300 lb. of bronze fittings from a lot of piping coming from a chemical works, and it is interesting to note that $2.50 per ton was allowed off the price of the scrap iron on account of its being very dirty. In dealing with war scrap, however, much of the metal is dirty, and it is quite possible for a fair amount of copper or brass to be missed in the collection and quick overhaul given by the merchants, for which reason the sorting or the metal at the foundry should be done with the view of taking out all foreign metal from the iron.

Do not attempt to take metal plugs out of unbroken shells; it is too risky unless the work is done by skilled men used to the class of projectile dealt with. This matter must be rather carefully kept in mind. Somewhat careful sorting of the metal will have to be done to get different grades, for while most of the iron and steel used is good, there are variations in both quality and hardness, a small Maxim shell being of different quality from a 14-pounder. Many of the shells also are made from scrap metal, which again causes a difference in quality and this has to be considered, but generally a good sorter can turn out very regular piles of graded metal for most purposes.

For work which has not to be made to any particular specification, old scrap from the battlefield forms a fairly cheap and handy form of metal, and probably will form a large part of the iron used in many places in the near future, as the supply will be extremely large. Probably some kind of flux will be necessary in the furnace when melting to secure the better amalgamation of the different irons, but will only be determinable where the scrap is being dealt with.

Other scrap, such as cartridge shells, rings, and plugs from heavy gun shells, bullets with their nickel cases loaded with lead, and similar waste, will be collected and eventually find their way into the hands of melters and foundrymen, and as they are all good metal according to their kind, they usually are worth buying. Some care is necessary to see that live cartridges are not present amongst the smaller stuff, and as a rule cartridge cases should be melted by themselves after careful sorting and examination. Denotations sometimes occur where cartridges have not exploded and such things should be viewed with suspicion, although they are not always dangerous.

In sorting this form of scrap, brass, gunmetal and copper, nickel and lead will be found, and as each is of good quality, the metals can be used right away, but generally it is desirable that they should first be run into ingots to maintain regularity of content. Of course, the bullets will be heated to separate the lead from the nickel, the molten lead being at once run into ingots, while the nickel shells, after being well roused about to shake out the molten lead, will have to be melted down in crucibles. In this sort of work, large crucibles of at least 4-cwt. capacity should be used, and for this purpose tilting furnaces will be found very convenient. Most of the soft scrap metal requires the use of some deoxidant flux when melting for making into ingots, but after being once cleaned out there should be no further difficulty in regard to occluded oxides and dirt, the actual casting work being practically the same as with new metal.

PREVENTING OF SPARKING OF SMALL DYNAMOS.

(Continued from page 134.)

permanently on segments where convenient.

Having now fixed in the brushes and bedded them nicely on the commutator, with light pressure, start up slowly and run for a while, wiping the commutator with dry duck if necessary. If commutator and brushes tend to bind at first, apply a very little vaseline to just lubricate. Now increase the speed, and if sparking occurs, adjust the rocker-arm, bearing in mind that for increased load, brushes go forward, and vice versa. If commutators and brushes be examined at stated intervals, say every week, and records be kept of the date when adjustments or renewals are made, of original maker's diameter of commutator, size of segments, insulation, etc., diameter when trued up, etc., breakdowns and burnouts will be greatly reduced. Further, and what is perhaps more important, you know in your private office whether the commutator trouble is with the man or with the machine when the current becomes erratic.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW AUTOMATIC NUT-TAPPING MACHINE.

MORE energy and inventive genius have been expended, perhaps, on the bent or curved tap principle in an effort to develop a continuous, non-reversing nut tapper than have been spent in the development of any other class or type of bolt and nut machinery. Numerous firms and individuals have experimented extensively with the bent tap, and while in theory all the requisite steps or movements, from the introduction of the nut blank to its ejection as a tapped nut, have apparently been successfully evolved, in practice the various designs show shortcomings more or less fatal commercially.

Nevertheless, the quest or effort to utilize the bent tap has gone on uninterruptedly, as the degree of success attained indicated that the bent tap held much promise and, that in theory at least, it offered the way for a full automatic nut tapper without any reversing action to wear out taps and cause trouble, and in which the various movements wuuld be obtainable without the employment of intricate or delicate mechanism, which has brought automatic tappers into ill favor generally, because of the constant and expert attention necessary.

These possibilities have, it is claimed, now been realized in a new automatic nut tapper being offered by the National Machinery Co., Tiffin, Ohio, and on lines even simpler than embodied in the theories and dreams of the early experimenters. This tapper is being built in sizes of 1/4, 3/8, 1/2 and 3/4 inch capacity, and the various illustrations show the movements and operation.

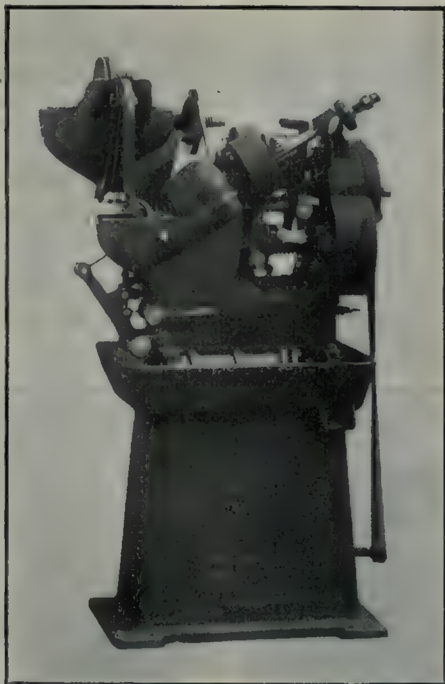


FIG. 1. NATIONAL AUTOMATIC NUT TAPPER.

The hopper or container for the blanks, while apparently on accepted lines, embodies sime original ideas and is made unusually large. On the smaller size machines, it accommodates about 80 lb. of blanks, this giving the operator considerable time between fillings, and enabling him to easily attend a battery of from 6 to 10 machines. A vane type feed progresses the nuts from the hopper to the feed chute, and gravity brings the blanks down and into position against the plunger or starter. There are four of these feed vanes, and they are so enclosed that the pressure or weight of the blanks cannot interfere with their successful operation. These vanes are rotated by a ratchet and pawl off the driving shaft, and this ratchet is held between friction flanges so that in case scrap or thin nut blanks tend to wedge in the nut groove and interfere with the vanes, the ratchet merely slips, and damage is prevented.

The tap spindle and injector or starter are inclined at an angle, and the blanks come out of the feed chute at a like angle, causing each blank to lay against the starter as it is advanced onto the tap. The angle of the starter is such that the lubricant keeps the face free of chips, and the blanks lay or bear flush against the starter, and are thus tapped square with the bearing face.

The tap spindle has a slight lateral travel, and is counterbalanced, giving the spindle a floating movement in a sense, and after the starter has fed the blank part way onto the tap, the spindle descends during the completion of the tapping, thus keeping the blank stationary while it is being tapped, in place of pulling it through the nut holder or guides, and incurring a chance of binding, with attendant excessive wear on the nut guides and tap.

The course of the nut after being

FIG. 2. NEAR VIEW OF WORKING MECHANISM, SHOWING HOW ALL GEARS AND REVOLVING PARTS ARE GUARDED.

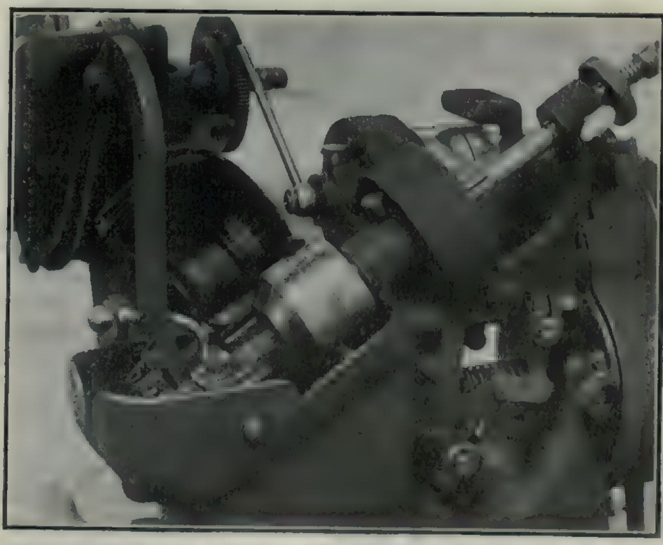


FIG. 3. HEAD COVER OR GUARD OPEN, SHOWING A NUT ABOUT TO BE EJECTED FROM THE HEAD. THIS COVER OR GUARD DIRECTS THE EJECTED NUTS.

tapped, i.e., its travel up the shank and off the end of the tap, is made clear in Fig. 4. The hood or cover over the head serves to direct the nuts ejected from the tap into a chute that conveys them out of the machine into boxes or kegs.

It follows, of course, that the better the quality of blank being tapped, i.e., freedom from burr, holes of correct size, stock free cutting and blanks of correct dimensions—the higher the machine's efficiency, and all blanks before being dumped into the hoppers are sorted for scrap, slugs, etc.; but should any scrap accidentally enter and be passed through the feed chute and fed against the tap, an automatic relief shifts the belt and stops the machine.

The design is intended primarily for tapping square nuts, but hexagon nuts of good quality can be handled; and each size tapper can be tooled for handling both styles of nuts, as well as for several sizes. Also by making a simple gear change, the rate of feeding, number of nuts tapped per minute, can be regulated to suit the kind of nuts being tapped. As an example, in the ⅜-inch size machine, 40 nuts of shop size can be tapped per minute if the stock if free-cutting, and holes are full size, etc.; whereas U.S.S. nuts being thicker require more turns of the tap to a nut, hence 30 nuts per minute are recommended. This also applies when nuts are of tough stock or the holes run smaller than standard.

No special type or grade of tap is necessary, and any standard tap that has been successfully employed in a shop in the straight shank will be found equally satisfactory in the bent form for this new automatic tapper.

These tappers, we understand, have been installed in a number of the big nut plants, and are showing a high efficiency. The absence of intricate mechanism and delicate parts in this tapper means elimination of much petty repair and more or less constant attention.

FIG. 4. HEAD OR TAP HOLDER OPENED, SHOWING HOW THE NUTS PASS OVER THE TAP AND ARE EVENTUALLY PUSHED OFF OR EJECTED BY ONCOMING NUTS.

FIG. 5. DETAIL VIEW SHOWING LARGE HOPPER. ALSO RATCHET AND PAWL WHICH ROTATE THE CONCEALED FEED VANES.

DRY DOCK EQUIPMENT CONTRACT.

THE general contractors for the Lauzon Dry Dock, Quebec, M. P. and J. T. Davis, have awarded the Canadian General Electric Company the contract for the apparatus required in the engine room and pump house. It includes three horizontal condensing steam turbo-generators, one of 300 k.w., another of 750 k.w. and a third of 1,500 k.w., with the necessary condensing apparatus, and also a 100 k.w. vertical engine driven direct current generator set.

The main switchboard in the lower house will consist of nine panels, and in the pump house there will be three individual motor panels connected in series with the corresponding panels in the power house, so that the large motors can be controlled at either place. Canadian General Electric Co. apparatus is used throughout. An outstanding feature of the main switchboard is the use of Thompson astatic instruments which are not affected by the heavy stray fields so commonly met with on d.c. switchboards of high ampere capacity. Errors due to such stray fields can only be avoided by using properly shielded instruments which have the fields astatically arranged.

For general drainage purpose there will be two Mather & Platt axial flow centrifugal pumps each of 6,000 Imperial gallons per minute capacity against 40 ft. head and driven by a 125 h.p. motor. For the main dock there will be three Mather & Platt 42-in. axial flow centrifugal pumps, each designed for 63,000 Imperials gallons per minute against a head of 25 feet. Each of these pumps will be driven by a 750 h.p. motor. There will also be a Mather & Platt new type centrifugal pump capable of handling 2,600 U.S. galons per minute against a head of 25 feet for hot-well purposes, and standard underwriters' steam fire pump of 500 gallons per minute, two outside end-packed boiler feed pumps, a Cochrane feed water heater and other appliances.

ELECTRO-DEPOSITING.

ELECTRO-DEPOSITING is very largely used in printing offices, not only in the making of process blocks, but also in plating or facing stereotypes with copper or nickel for the purpose of hardening the surface and permitting much longer runs than is possible from the plain stereo. Ordinary copper electrotypes, when not nickel-faced, soon wear down, and give a poor impression.

The usual method of making an electrotype of a process block or an engraving in an electrically-driven works is to first of all prepare a wax mould in the electrically-driven hydraulic press. The surface of this is then rendered conducting by treatment in an electrically-driven black-leading machine, and a copper shell is then deposited on the wax mould in the electric bath, the shell being afterwards backed up with molten metal and fixed to a wood block "type high." For long runs, the face of the block may be nickel-plated. The latest method is to electrically deposit nickel steel direct on to the prepared wax mould, a very thin deposit only being necessary. The mould is then washed and transferred to the copper bath, where it is electrically backed up with copper and is afterwards backed and prepared in the usual way.

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PRINCIPAL CONTENTS.

'TIS NO TIME TO WHINE.

HOWEVER unconsciously we may have become participants in this almost all-European War, there is no disputing the fact that, as the weeks and months have sped since early August last, we have been in process of realizing that not only were we involved but, as a privilege and of necessity, we had also a duty to perform. In these particulars as regards accomplishment we have nothing to be ashamed of and we no doubt are determined to surpass rather than merely maintain the present achievement record. It may at once be said that we have given quite unstintingly of our manhood, our womanhood and our substance for the cause of Empire, notwithstanding which, as a nation within that Empire we are relatively richer in many respects than otherwise.

Within the past week we have again been reminded—rather more forcibly perhaps because of its imperiousness, that we are involved with Britain, and that her affairs, of whatever nature, are ours as well. Canada's War Budget has been declared, and even though as regards details, to a large extent anticipated, it has, judging by appearances and noting observations, aroused considerable excitement and caused much commotion in the various spheres of our commercial, domestic and individual relationships and activities.

Arising out of the Budget proposals generally, as was naturally to be expected, all manner of extravagant ideas and statements are being promulgated. Business men we are led to believe have been precipitated headlong into a maze of figures and probabilities, and numbers of them—we had almost quoted Scripture, and said: "A multitude of them that no man could number,"—are ready to shut down. Criticism of certain details has also not been lacking in the elapsed although short period, and while always justifiable for cause or reason, may nevertheless often be narrow and circumscribed in its outlook.

In its essence, our War Budget gives added protection generally to Canadian manufactured products and at the same time added preference comparatively to imports from Britain. The latter, however, is meantime and will continue to be for the next two years or more somewhat of an "intangible asset" to British manufacturers, due to the fact that their output for home requirements is and will continue to be for at least the period named, far below the demand.

Regarding the 7½ per cent. increase in non-preferential instances, it may be incidentally remarked that the amount is substantial, but at the same time neither a real or imaginary barrier to hinder anyone purchasing what they want, just because they want it from necessity. As long as there are seams in the board fence round the ball yard there will be fans outside as well as inside following the game, and in like manner no tariff however apparently prohibitive will stand in the way of those who want to see, know and participate in machinery improvements, etc.

The Minister of Finance has taken full and cunning advantage of the exceptional opportunity afforded. He has not only sought by the various enactments to foster Canadian industry, but he has done so at a time when tariff or no tariff, the all pervading application of our varied enterprise is that due to the European War, and for the profitable accomplishment of which we have had and will have of necessity to import largely.

The purpose of the tariff and tax imposts, particulars of which are to be found in another section of this issue, is to provide additional revenue, and this can best be achieved by our practising "Business as Usual." This, mark you, has no kinship with the "Business as Usual" propaganda with which the opening weeks of the war was haloed. Rather is it the unaffected war-tariff-and-tax—unconscious pursuit of our affairs that has in recent weeks marked our steady uplift to early future normal times again.

We have said that criticism of the Budget provisions is in evidence, and some people individually or collectively, or both, may be rather heavy sufferers comparatively. A number of the enactments are almost sure to become permanent; as for instance the stamps on commercial paper, while others again may be more or less tardy of erasure from the statutes. In any case, the personal and individual exemptions as burden bearers are few, and taken altogether, who of us would be disposed to bear any less share in supporting our Empire in the cause to which she with her Allies have committed themselves?

Canada's 1915 Budget is a call to her people's patriotism, and that they will respond equally whole-heartedly as with her sons and daughters there is not a glimmering of doubt. Let us continue then to make it "Business as Usual."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 40
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	18 75	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	18 75	.....
Clarence, No. 3	18 75	.....
Glengarnock	22 00	22 75
Summerlee, No. 1	23 00	.....
Summerlee, No. 3	22 50	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	20 00	19 00
Victoria, No. 2X	20 00	19 00
Victoria, No. 2 Plain	20 00	19 00
Hamilton, No. 1	18 00	17 00
Hamilton, No. 2	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal	2.05
Steel bars, f.o.b., Montreal	2.05
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.10
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.10
Beanms and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates ¼ to ½ in., 100 lb.	$2 25	$2 25
Heads, per 100 lb.	2 45	2 45
Tank plates, 3-16 in.	2 50	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 9 50
Copper, crucible	10 00	10 50
Copper, unch-bled, heavy	9 50	10 50
Copper wide, unch-bled	9 50	10 50
No. 1 machine compos'n	8 50	9 50
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	8 00
No. 1 brass turnings	6 00	6 75
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	4 50	5 00

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Feb. 13, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal
Standard				
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 1½ in.	74	63	....	....
2 in.	74	63	70	59
2½ to 4 in.	74	63	73	62
4½, 5, 6 in.	....	....	72	62
7, 8, 10 in.	....	....	68	57
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	43	....	....
½ in.	63	52	....	....
¾ to 1½ in.	68	57	....	....
2 in.	68	57	64	53
2½, 3 in.	68	57	67	57
3½, 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	65	55
7, 8 in.	....	....	61	50

Wrought Nipples

4 in. and under	72½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake Copper, carload	$16 35	$16 50
Electralytic copper	16 25	16 25
Castings copper	15 75	16 00
Tin	41 00	43 00
Spelter	9 25	10 75
Lead	5 00	5 65
Antimony	19 50	20 50
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	.1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.70
Linseed oil, boiled, single bbls.	0.73
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 80	$2 80
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 00	4 05
Apollo brand, 10¾ oz. (galvanized)	4 10	4 00
Queen's Head, 28 B.W.G.	4 25	4 45
Fleur-de-Lis, 28 B.W.G.	4 00	4 35
Gorbal's Best, No. 28	4 50	4 55
Viking metal, No. 28	4 00	4 10

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 09¾
X Grand	0 09¼
XLCR	0 08¾
X Empire	0 08
X Press	0 07¼
COLORED.	
Lion	0 06¾
Standard	0 06
Popular	0 05½
Keen	0 05
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 06½
WASHED WIPERS.	
Select White	0 08½
Mixed Colored	0 06
Dark Colored	0 05

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 15, 1915.—Perhaps the most interesting event of the week in industrial circles has been the announcement of the tariff changes and the war taxes. The declaration will have a direct effect on the steel trade, because of its bearing on imported steel goods. As regards pig iron, prices all around will be increased from one to two dollars per ton. Pervading the steel trade, there is a much better feeling, and it is very confidently expected that business will develop satisfactorily as far as Canadian mills are concerned. At the moment, however, conditions are much as they have been for the last six weeks.

In metals there has been a general increase in price, due to the increased duty. Business here also has been much as usual during the week, there having been no particularly interesting developments and no price changes of note.

The Steel Market.

Inquiries being received for steel are quite encouraging, and a considerable amount of business is likely to result from them later. Orders for shrapnel shells continue to be placed in Canada, and this war-time industry is contributing to the keeping of our machine shops busy.

Pig Iron.

About the same volume of business continues to be accorded in pig iron. The general condition, however, represents a very dull market. Prices will go up on all imported material because of

the new tariff regulations, and home brands will no doubt follow suit. The meantime effect will not be as noticeable as it will be later when the requirements begin to tend towards normal.

Machine Tools.

In general lines of machine tools little or no trade is passing, but in the matter of specialties, etc., for machining shrapnel shells, the demand continues good, although it is almost impossible to get deliveries under two or three months.

Machine Shop Supplies.

In bolts, nuts, screws, and rivets there will undoubtedly be a decided price increase as soon as matters are adjusted, but at the time of writing no advances have been made. For wrought pipe, boiler tubes, copper rivets, etc., increases have already taken place. Tool steel will also register an advance. Metal sheets have gone up considerably. Business in supplies has been very good of late on account of the increasing number of shops engaged in war orders.

Metals.

On account of the increased duty, copper of all grades has gone up from $1 to $1.10 per hundred pounds. Lead has gone up one-quarter of a cent per pound. Tin has gone up 2½ cents per pound. Spelter, antimony and aluminum have also advanced. Business has been rather free from startling developments during the week.

Toronto, Ont., Feb. 16, 1915.—The outstanding topic this week in business circles is the new tariff schedule, and opinions naturally vary as to the effect that it will have on trade. It is generally considered to be fair and equitable and that under prevailing conditions very little dislocation will be experienced. There will of necessity be extra labor entailed in preparing price sheets and some time may elapse before the situation is entirely adjusted. As the entire schedule with few exceptions has been increased 7½ per cent., on the intermediate and general tariff, and 5 per cent. on the preferential, it follows that there will be a corresponding advance in the price of imported goods. No information is available as yet as to what action Canadian manufacturers generally will take on account of the tariff on raw materials, but it is probable that in some cases they will increase their prices. In some instances this has already happened. The higher tariff may have the effect of temporarily depressing business to some extent, as for some time past consumers have been restricting their buying to such goods as were most urgently needed. Apart from the question of increased revenues and the benefits derived therefrom, the higher tariff will be of some assistance to Canadian manufacturers notwithstanding the higher cost of raw materials. Our manufacturers should be able to turn the situation to good account by establishing new connections and generally developing their business.

The iron and steel trade has not, so far, been materially affected by the tariff, and business is quiet. Prices on domestic products are unchanged with the exception of wrought iron pipe which has advanced. Scrap copper prices are higher on account of the continued strength in the copper market but other lines are unchanged. Tin and spelter are higher but other metals are unchanged except for the addition of 7½ per cent. duty to the last quotations. The machine tool market is quieter but some nice business is in view. The supply business is quiet, and imported goods have advanced.

Steel Trade.

The new tariff may be of some benefit to the iron and steel trade, but business has been so dull of late that it is doubtful whether under prevailing conditions much development can be expected even with a higher tariff. When industrial conditions improve, the steel trade will benefit to a greater degree than under the old tariff as outside competition will be restricted to the extent of the extra duties. Prices on all steel products entering Canada have been advanced. Pittsburgh bars, plates and shapes laid down in Canada are approximately $1.80 per 100 pounds higher, but warehouse prices have not been changed for the present. Galvanized, black sheets and Canada plates have advanced 10c per 100 pounds. Boiler plates and tubes are higher, and the discounts on cold drawn steel shafting are being adjusted. Wire nails, galvanized and barbed wire have advanced 5c per 100 pounds at Pittsburgh. There has been no change so far in the prices of domestic steel products, except in wrought iron pipe, which will be referred to later.

Pig Iron.

The duty on pig iron has been increased, but the tonnage now being imported is comparatively light, so the effect will not be very noticeable at present. There has been an all round advance in prices on account of the tariff.

Machine Tools.

There has been diminished activity in the machine tool trade this week, although orders continue to be placed for equipment for machining shells. Business in other lines is quiet. The increase in tariff will probably not greatly affect the import trade, as only special tools and those urgently required have been coming in recently. There is a possibility of Canadian makers benefiting by the tariff when conditions improve, but at present there is not much demand for tools other than those used for making shells.

Supplies.

There is a little better demand for supplies. Prices on imported lines have advanced and lists are being revised. Prices of supplies made in Canada are unchanged and no information is available as to what steps manufacturers propose taking. Indications are that the higher duties will increase the demand for domestic goods. Linseed oil has advanced 2 cents, being now quoted at 70c per gallon for raw and 73c for boiled. Turpentine is unchanged but the higher tariff may cause an advance. A revision in the price list of cotton waste is anticipated.

Metals.

Metals in the form of ingots or pigs have until recently entered Canada free of duty. They are now dutiable to the extent of 7½ per cent., which is included in this week's quotations. There is a fair demand locally and quotations are firm. Tin and spelter have advanced 1c and 1½c per pound respectively. Other metals are unchanged except of course for the duty, 7½ per cent., which is included in all cases. Tin is higher in the primary market and is firm on account of large demand. Tin is now quoted at 43c per pound. The copper market is quiet and unchanged at New York. Lake copper is quoted locally at 16½c per pound. The spelter market continues to move up and is strong, and spelter is quoted at 10¾c per pound. There is a good demand for lead, and the market is firm with the possibility of an advance. In the local market the price is 5½c per pound. Antimony is strong at 20½c per pound, but aluminum is dull at 23½c per pound.

Scrap Metals.

The recent advance in the copper market has affected scrap copper, and prices have advanced ½c per pound. The following are the new quotations: Light copper, 9½c; crucible, 10½c; heavy, 10½c; wire, 10½c; composition, 9½c; brass clippings, 8c; brass turnings, 6¾c per pound. Scrap zinc is now quoted at 5c per pound.

W. I. Pipe.

Prices of wrought iron pipe have been advanced. The new discounts, which went into effect on Feb. 13, are given in the selected market quotations.

The General Machinery Co. of Montmagny, Que, and the F. X. Drolet Co., Quebec City, have, it is understood, received contracts for shells from the British Government.

Canada's War Budget--Tariff Changes and Tax Impositions

Anticipation that the Budget for 1915 would be of more than usual individual interest has been quite fully realized, and in order that our readers may readily familiarize themselves with its aims, provisions, etc., there is provided the following detail summaries:

THE European war has affected the finances of Canada in two ways. It curtailed trade, which meant a reduction in the customs revenue, and made necessary expenditures which almost doubled the demands upon the treasury; besides, this came at a time when large obligations had been assumed for public works, and there had been going on for years development of administrative activities which meant heavy and permanent increase of the regular expenditures.

The estimates for the coming year laid before Parliament call for $146,000,000 for ordinary Governmental work and $44,000,000 additional for such purposes as completing the National Transcontinental Railway, constructing the Welland and other canals, and improving facilities for navigation. Then there is the war expenditure, for which a vote of a hundred million dollars is asked for the coming fiscal year, making the whole amount that may be required during the twelve months close to $300,000,000.

The probable revenue is only $120,000,000, but arrangements have been made with the British Government for obtaining the money needed for the war at a low rate of interest. There will still be the necessity, however, for heavy borrowing for purposes other than that of the war.

Some $30,000,000 has been reckoned necessary to meet the increased interest charges, to bring revenue up to normal or ordinary expenditure, as well as to ensure a balance against eventualities

WAR BUDGET SUMMARY

Briefly stated, with a small list of exceptions, there is a general all-round increase of 7½ per cent. on the general and five per cent. in the British preferential tariff.

Special war taxes are imposed upon banks, insurance companies, railways, cable and telegraph companies and patent medicines.

On bank note circulation there is to be a tax of one per cent., and on trust and loan companies a tax of one per cent. on the gross income.

Insurance companies, except life and marine concerns, will pay one per cent. of net premiums

All cable and telegraph messages will pay a tax of one cent each.

From all railway and steamship tickets, the Government will collect five cents from each, where the ticket costs up to $5, and five cents for each additional $5 of cost.

On parlor car seats and sleeping berths there will be a tax of 10 cents each.

A tax of $1 is levied on steamship tickets costing up to $10 to all points other than in Canada, U.S. or West Indies; $3 for berths exceeding $30; and $5 for berths over $60.

There will be a stamp tax of 2 cents upon commercial paper, such as receipts, checks, transfer and business agreements, as well as on express and money orders.

Every letter and post card will bear a one-cent war stamp, bills of lading a two-cent stamp and postal notes one cent; patent medicines one cent for each ten cents of cost.

Upon non-sparkling wines there will be a tax of five cents per quart; upon champagne, 25 cents per quart.

By reason of the trade conventions with the British West Indies and France the increased duties do not apply to silk fabrics, velvets, ribbons and embroideries.

EXEMPTIONS FROM TARIFF INCREASE.

The list of items in the tariff schedules or in the former free list which are exempt from the general tariff increase announced, is as follows:

Fish from Newfoundland,, animals for the improvement of stock, cocoa and chocolate products, tea, salt for the fisheries, Indian corn except for distillation purposes, wheat, wheat flour, sweetened biscuits, squid, oysters, seed and breeding; fish and fish eggs for propagating purposes; sugar, tobacco, wines from South Africa; books (printed), newspapers and magazines, news printing paper, matrix paper; nicotine sulphate, ores of metals, bells for churches; gold and silver coin and gold and silver ingots, blocks, bars, drops, etc.; typesetting and typecasting machines, newspaper printing presses; mowers, binders, harvesters and reapers, traction ditching machines; surgical and dental instruments; material for ships, binder twine, articles for the manufacture of binder twine, fish hooks, lines, twines and nets for the fisheries, artificial limbs, artificial teeth not mounted, articles specified in tariff for schools, hospitals and charitable objects, settler's effects. The customs duties on the foregoing remain unchanged.

Only five specific agricultural implements are exempt from increase in duty, viz:—

Reapers, binders, mowers, harvesters and ditching machines. All others are subject to the 7½ per cent. increase, which means an average increase from 20 to 27½ per cent. on ploughs, cultivators, harrows, discs, threshing machines, waggons, etc.

The tariff changes, according to custom, went into effect immediately on announcement, February 11. With regard to the special taxes, those on wine and champagne go into effect at once, and the others at a date to be fixed.

and, to provide this, a general tariff increase has been imposed of seven and a half per cent., general and intermediate, and five per cent. preferential, applying to all articles whether now dutiable or on the free list, with, however, a list of exemptions, including tea, cocoa and chocolate, sugar, wheat and wheat flour, tobacco, books, newspapers and magazines, agricultural implements. From the operation of the foregoing, a revenue of from $20,000,000 to $25,000,000 is anticipated.

In addition, special war taxes are imposed on banks, insurance, railway, cable and telegraph companies, and on patent medicines, from which sources a revenue of some $8,000,000 is expected.

In the accompanying table, columns 1 and 2, are shown the general nature and monetary value of the business done by Canada during the last year, while, based on same, in column 3 is given the revenue arising out of the new tariff and tax impositions. From the latter figures it will be noted that there is a close approximation to the $30,000,000 expected to be raised.

Dutiable Goods.

	Value	War Tax
Bar iron, etc.	$ 3,700,000	$ 277,500
Castings	1,400,000	105,000
Gas engines	2,500,000	187,500
Pipe fittings	1,000,000	75,000
Bridges	1,000,000	75,000
Pig iron	2,500,000	187,500
Portable engines	2,300,000	172,500
Threshing machinery	1,200,000	90,000
Spinning machinery	1,800,000	135,000
Machinery	14,800,000	1,100,000
Steel rails	5,000,000	375,000
Steel angles, etc.	2,800,000	210,000
Rolled beams	6,000,000	450,000
Steel plates	4,600,000	345,000
Galvanized sheets	1,000,000	75,000
Skelp iron	2,700,000	202,500
Iron and steel pipe	1,300,000	101,500
Steel plate, bridges	1,600,000	120,000
Rolled steel bands	1,000,000	75,000
Steel manufactures, N.O.P.	10,000,000	750,000
Jewelry	1,700,000	122,500
Boots and shoes	4,200,000	315,000
Magic lanterns, etc.	1,200,000	90,000
Lamps, etc.	1,500,000	112,500
Nickel-plated ware	1,400,000	105,000
Phonographs, etc.	1,000,000	75,000
Coal oil, etc.	1,300,000	101,500
Watch actions	1,200,000	90,000
Wood manufactures	2,000,000	210,000
Wool manufactures	20,700,000	1,652,500
Clothing—wool	2,600,000	195,000
Carpets, etc.	2,300,000	172,500
Oilcloth, etc.	1,500,000	112,500
Optical instruments	1,000,000	75,000
Packages	3,000,000	225,000
Paper, n.o.p.	2,500,000	187,500
Wrapping paper	2,400,000	180,000
Post office parcels	1,500,000	112,500
Butter	1,800,000	135,000
Bacon	1,000,000	75,000
Pork	1,200,000	90,000
Ribbon	1,800,000	135,000
Seeds	1,200,000	90,000
Silks and clothing	7,300,000	547,000
Brandy	1,200,000	90,000
Whiskey	3,000,000	225,000
Sugar	14,000,000	1,050,000
Sugarcane	1,000,000	75,000
Tobacco	1,400,000	105,000
Vegetables	1,500,000	112,500
Ales and porter	1,300,000	97,500
Pictures, etc.	1,000,000	75,000
Breadstuffs	3,200,000	240,000
Brass manufactures	2,000,000	150,000
Brick	1,300,000	97,500
Automobiles	11,000,000	825,000
Cotton	5,700,000	427,000
Prints	6,500,000	487,500
Sheets	1,200,000	90,000
Clothing, cotton	3,000,000	225,000
Cotton lace	1,200,000	90,000
Cotton socks	1,000,000	75,000
Cotton velvets	1,000,000	75,000
Cottons, n.o.p.	1,000,000	75,000
Medicines and drugs	2,000,000	150,000
Chinaware	2,000,000	150,000
Electric apparatus	6,500,000	487,500
Electric motors	1,800,000	135,000
Express parcels	2,000,000	150,000
Lace, n.o.p.	1,200,000	90,000
Toys, etc.	1,000,000	75,000
Linen damask	1,000,000	75,000
Fruits, nuts, etc	8,600,000	645,000
Furniture	3,000,000	225,000
Glass carboys, etc.	1,600,000	120,000
Window glass	1,500,000	112,500
Gloves and mitts	2,700,000	197,500
Waterproof clothing	1,600,000	120,000
Rubber tires	1,400,000	105,000
Rubber manufactures	1,000,000	75,000
Hats, etc.	2,000,000	150,000
Straw material	2,600,000	195,000
Railway cars	5,200,000	390,000
Bitumenous coal and stock	26,000,000	2,050,000
Cotton duck	1,000,000	75,000
Embroidery	1,100,000	82,500
Total	......	$20,837,000

Free List.

	Value	War tax
Iron ore	1,900,000 tons	$ 152,000
Fence posts and ties	$ 2,300,000	172,500
Lumber	12,000,000	915,000
Fur skins	2,200,000	165,000
Hides	8,700,000	752,000
Wool	1,800,000	135,000
Nitrate of soda	1,600,000	120,000
Jute cloth	2,700,000	202,500
Wire rods	1,600,000	120,000
Machinery	1,000,000	75,000
Tin blocks and plates	5,400,000	405,000
Wire	1,300,000	97,500
Petroleum	6,000,000	450,000
Cotton rags	1,400,000	105,000
Cotton	9,700,000	775,500
Bananas	2,600,000	195,000
Oranges, etc.	3,300,000	247,500
Manilla grass	1,300,000	97,500
Rice, uncleaned 0	1,100,000	82,500
Tobacco	5,000,000	375,000
Coke	2,000,000	210,000
Chicle	1,500,000	112,500
Rubber, crude	3,200,000	240,000
Cotton yarn	1,000,000	75,000
Coffee	2,000,000	150,000
Total	......	$ 7,439,000
Grand total	......	$28,276,000

CANADIAN LUMBER OUTPUT.

Despite the depression in construction work throughout the Dominion, lumbering operations upon Crown timber limits in Ontario this winter will measure closely to the records of the past year. One reason for this is that while the market has been falling off, lumbering companies have been able to hire men at lower rates and many are at work, anticipating an improvement in demand next year.

According to estimates received by Aubrey White, Deputy Minister of Crown Lands, the cut of pine this year will amount to approximately 375,000,000 feet, compared with about 360,000,000 last year. The cutting down of railway construction is reflected in a decided falling off in the estimated output of ties. Crown timber limits produced over 6,000,000 ties last year, and unless the estimate of the Government experts is below the mark, the total this year will not reach much above a million.

The enormous consumption of paper since the war started has created a demand for news print that the pulp and paper mills are trying to keep up with. Last year's production of pulpwood on Crown lands was 131,000 cords, but this year it is expected the output will reach 425,000 cords. A large part of the increase will be due to the activity of the Abitibi pulp and paper mills established in the North under arrangement with the Ontario Government, and now setting down to production in earnest.

The output of spruce, hemlock and other varieties will also be increased. The estimate puts the cut of spruce at 18,000,000 feet, hemlock 27,000,000 feet, and other varieties 39,000,000 feet. The cut under these headings in 1914 amounted to 65,000,000 feet.

DOMINION TRADE RETURNS.

THE latest Canadian trade returns issued by the Department of Trade and Commerce indicate that the Dominion's trade, although falling off with Great Britain and nearly every other country owing to war conditions, is still rapidly increasing with the United States. The interruption of Atlantic transport since August last has resulted in the diversion to the United States of a considerable amount of Canada's import and export trade.

For the twelve months ending with November last Canada's trade with the United States aggregated $664,335,000, an increase of nearly $48,000,000 as compared with the preceding twelve months. Canada's trade with Britain during the same period totalled $298,496,000, a decrease of nearly $60,000,000 as compared with 1913. Canadian imports from the United States increased during the year by $28,000,000, and exports to the United States by $19,000,000. On the other hand, Canada's imports from Great Britain decreased by $40,000,000, while exports decreased by nearly $20,000,000.

LOCOMOTIVE WORKS PRESENTATION AND BANQUET.

THE officials and foremen from the various departments of the Canadian Locomotive Co., Kingston, Ont., met recently in the Frontenac Hotel, to pay their respects to Charles J. Goldmark, superintendent engineer, who was about to leave the city for New York. For some years Mr. Goldmark has been connected with the company. G. J. Clark presided and J. Johnson was master of ceremonies, while R. Agnew, master moulder, and W. Kennedy, constituted the guard, both being supplied with batons emblematic of their position.

The banquet was a huge success. After a toast to "The King," American Consul Felix S. S. Johnson responded to the toast of "The President of the United States," which had been proposed by G. J. Johnston. The former spoke of the good feeling existing between the two countries.

The presentation to Mr. Goldmark took the form of a loving cup, which

was turned out in the pattern shop of the locomotive works. The cup was made of pine and mounted on a ten-inch base and coated with aluminum. Messrs. Agnew and Kennedy carried the cup into the dining room and Dr. J. J. Harty made the presentation.

Mr. Goldmark made an eloquent reply to the address also tendered him, and expressed his appreciation of the gift.

A toast to "The Canadian Locomotive Company" was proposed by L. Wood and responded to by William Casey, sales manager. W. Kennedy and George Driver favored the gathering with songs for which they were heartily encored.

Several officers of the 21st Overseas Battalion were guests of the evening, and G. J. Clark proposed a toast to them and their comrades. This was responded to by Lieut. W. K. Macnee.

C. Hayes, assistant foreman of the pattern shop, J. Fleming, W. Kennedy, George Driver and L. N. Marchand contributed to the musical feature of the function.

TO ENTER ATLANTIC TRADE.

OWING to the fact that prospects are for light carrying business on the Canadian waterways during the coming summer, the Canadian Steamship Lines, Ltd., is making arrangements to transfer some of its largest boats to Atlantic routes. The opportunity is an obvious one on account of the tying up of Germany's merchant marine, and also on account of the large number of craft which have been commandeered by the British Government.

It is understood that there are about ten grain carriers of sufficient size to enter the Atlantic trade. There is also a very favorable feature in that ocean rates have increased to a large extent since the opening of the war and there is certain to be a strong demand for Canadian grain.

President Carruthers states: "As the ocean freight rates are quite high, they are very tempting to us. We have many boats capable of carrying ocean-going cargoes of grain and flour and all of these will be used for this purpose as soon as the lakes and canals are sufficiently clear of ice to permit of their being brought to Montreal harbor. We have all the room booked in our boats for May shipment and many more offers for May-June cargoes.

"Our boats will return to the lakes in the fall when the new crop begins to to come down."

Galt, Ont.—The annual meeting of the Board of Trade was held on Feb. 9. and the following officers were elected: Hon. President, F. S. Scott, M.P.; president, C. E. Dowler; vice-president, W. W. Wilkinson; treasurer, W. Phillips; secretary, J. H. Hancock; council, G. A. Dobbie, G. E. Turnbull, J. H. Fryer, J. Sloan, A. M. Edwards, F. S. Jarvis, J. H. Stauffer and T. Vair.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Coaticook, Que.—Sleeper & Akhurst, Ltd., have received an order for shells.

London, Ont.—The City Council are in the market for machine tools for the works department.

London, Ont.—The city contemplate purchasing pumps and motors. H. A. Braizier, city engineer.

Bassano, Alta.—The town council are considering the purchase of a turbine pump and cast iron piping.

Stratford, Ont. — Time recording clocks are required by the School Board. A vacuum cleaner is also required.

Hamilton, Ont.—Turbine pumps and motors will be required shortly for the new pumping station. A. F. Macallum, city engineer.

Hamilton, Ont.—The National Machinery Co., has received a contract for shells from the British Government amounting to $125,000.

Lindsay, Ont.—The Sylvester Mfg. Co., propose to erect an addition to their plant and equip same with the latest machinery for making gasoline and oil engines.

Quebec, Que.—It is rumored that the proprietors of the Ross Rifle Co., intend to acquire the Paquet factory at Hare Point for the purpose of establishing in that locality the new factory needed to fulfill the order for three million rifles which the company recently obtained from Russia.

Fort Erie, Ont.—A branch of the Curtiss Aeroplane Co., which has its main office and works at Hammondsport, N. Y., has been established in Fort Erie. The company are making some of the parts of aeroplanes, while other parts will be imported and the assembling done here. N. S. Hopkins is manager.

Electrical

Dutton, Ont.—A by-law is contemplated to raise $10,000 for the installation of a Hydro-electric power system.

Newmarket, Ont.—The Metropolitan by-laws will be submitted on Feb. 22. It is proposed to spend $15,000 on transformers and extension to the town system.

Niagara Falls, Ont.—If the present route for the proposed new power canal from the Chippewa creek to Queenston, where the Ontario Hydro-Electric Commission plans to construct a generating station, is followed, a tunnel nearly a mile in length will have to be constructed under Lundy's Lane, according to an engineer connected with the Hydro-Electric staff. This will cost more than $200,000, it is estimated, and will take a year to construct.

Municipal

Huntsville, Ont.—The council propose making extensions to the electric lighting system.

Hull, Que.—The city council are considering the purchase of a steam pump for the fire department.

Hamilton, Ont.—It is proposed to spend $100,000 on a fire alarm system. A by-law will be submitted to the ratepayers.

Winnipeg, Man.—The contract for additional improvements to the municipal hospital heating plant has been approved.

Winnipeg, Man.—Superintendent of Waterworks Hooper asked authority to purchase water meters required at a cost of $234.

Montreal, Que.—Plans are being prepared for the proposed tunnel under the Lachine Canal on Wellington street. Paul Seurot is consulting engineer.

Hamilton, Ont.—The City Council are in the market for equipment for the fire department consisting of a motor hook and ladder truck, and motor pumping truck.

Brockville, Ont.—A committee has been formed to secure tenders for a new intake pipe and to obtain expert advice on a filtration plant. G. H. Bryson is town engineer.

Lindsay, Ont.—A by-law will be voted on by the ratepayers on March 3 to authorize a guarantee of bonds to the amount of $30,000 to the Boving & Co., of Canada, Ltd.

St. Mary's, Ont.—The proposals submitted by the water and light commission to the town council have been approved by that body. The proposals cover the installation of a gasoline engine at a cost of $4,000, and a new street lighting system to cost $8,555.

Toronto, Ont.—The Board of Works has requested Works Commissioner Harris to insert $345,000 in his estimates to cover the cost of a bridge across the ravine at Moor Park. This will be the means of continuing St. Clair avenue east and west in a direct line.

Aylmer, Ont.—At a joint meeting of the town council and the Board of Trade it was decided to submit to a vote of the people both propositions now before the public—the hydro radial, the road from London via Westminster and Belmont, and the Traction line from St. Thomas.

Brockville, Ont.—In the investigation being conducted into the quality of the water supply as a suspected cause, a diver of the Donnelly Wrecking Co. has located a big break in the intake pipe on the river bed, through which sewage contamination is thought to have found its way.

Montreal, Que.—The Board of Control has decided to ask council for $39,500 for cables and electric light standards to be placed on St. Catherine Street, between Atwater and Papineau Avenues from Craig Street to Pine Avenue. If this amount be voted, tenders for the work will be called at once.

London, Ont.—Between four and five million feet of gas per day is the estimated output of a well that has been struck in the village of Delaware, a few miles from here. This is considered sufficient to supply the entire city of London. The well is owned by a London and Petrolea syndicate, which has leases on more than 40,000 acres in the district.

Toronto, Ont.—The Works Commissioner has reported to the Board of Control in favor of accepting the tender of the Merrill & Ruckgaber Co., for the construction of section two of the high level interceptor at a cost of $65,300. The appropriation for the work originally made by the Works Commissioner was only $25,000.

Winnipeg, Man.—Close on a million dollars will be saved to the Greater Winnipeg water district by the discovery of an easier route for the Shoal Lake aqueduct than the one originally mapped out. James H. Fuertes, of New York, consulting engineer to the district, thinks that the big undertaking will be finished

within the estimated cost and within the estimated time, and backed up his prediction with the encouraging information given above. He has just returned from one of his periodical trips over the route of the aqueduct.

General Industrial

Redcliff, Alta.—A proposition is being considered by a Calgary syndicate to establish a 200-barrel flour mill here to cost $20,000.

Port Arthur, Ont.—It is announced that work on the Canadian Northern coal and ore docks will begin shortly. Barnett & McQueen Co., are the contractors.

Windsor, N.S. — H. C. Burchell, of Sidney, N.S., is interested in a company who propose establishing a plant here for quarrying and milling limestone and shale to make a fertilizer.

Coppercliff, Ont.—It has just been announced that the Canadian Copper Co., the largest producer of nickel in this district, will immediately reopen its No. 2 mine here, also the Crean Hall mine.

Vancouver, B.C.—Ramsay Bros. & Co., have acquired the chocolate plant of the Pacific Chocolate Co., of New Westminster, and will move and install it in their present commodious building on Powell Street.

Petrolia, Ont.—A charter has been secured under the Ontario Companies' Act, under the name of Petrolia Flour Mills, Ltd., with an authorized capital of $40,000. F. S. Brown, of Toronto, is interested.

Trade Gossip

Toronto, Ont.—Schofield-Holden Co. has taken out a five-year lease of No. 415 to 419 King street west for $15,000.

The Mechanical Engineering Co,. have moved their office and works from 129 Mill street, to 55 Cote street, Montreal.

Army Enamelware Orders.—Superintendent Grampp of the Stamped Enamelware Works, Hespeler, Ont., has secured a large order for granite plates, cups, bowls and water bottles.

London, Ont.—The arrangement between the City Council and Board of Trade, by which Gordon Phillips is appointed as Industrial Commissioner, was reaffirmed on Feb. 15, by City Council.

Summerside, P.E.I. — Neil McLeod brought up before the Board of Trade the matter of appointing an industrial commissioner to represent this province in Boston or some of the large centres of the United States.

The Berg Machinery Mfg. Co., of Toronto, are endeavoring to sell their plant consisting of boiler, machine, foundry and pattern shops, etc. J. P. Langley & Co., McKinnon Bldg., Toronto, are the assignees.

Oshawa, Ont.—The election of officers for the Board of Trade resulted as follows:—President, Col. J. F. Grierson; vice-president, J. W. Provon; sec.-treas., D. A. J. Swanson; council, J. F. Tamblyn, T. B. Mitchell, J. Stacey, H. B. Samells, A. S. McLeese, W. L. Law.

Maritime Province Shell Production.—Ae present the Nova Scotia Steel & Coal Co. and Nova Scotia Car Co. plants are turning out a large number of rough shells daily and finishing equipment for same is being rapidly installed. Similar provision is being made at the Eastern Car Co. and McNeil shops.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Car Order Rumor.—The story is prevalent that the officials of the Eastern Car Co. are figuring on an order for fifteen thousand cars for the Russian government. At present two representatives of the New Glasgow concern are in Russia looking for orders, and it may be they have run across this find.

Berlin, Ont.—Notwithstanding a decrease of more than $4,000 in receipts last year, the Berlin & Waterloo Street Railway, owned by the city, reports a net profit of $405.70 for 1914. Total receipts amounted to $72,973.69. Seventy-five per cent. of the profits will be paid to the Berlin treasury and the balance to Waterloo.

Brandon, Man.—At the annual meeting of the Board of Trade the election of officers resulted as follows: President, A. Shewan; vice-president, O. L. Harwood; secretary, Clarence King; directors, J. Cornell, A. E. Evans, J. Howard Rankin, J. S. Wilmott, A. E. McKenzie, A. D. Rankin, J. H. Hughes, J. S. Maxwell, A. A. Evans, K. Campbell, P. Kennedy and C. L. Cummings.

Fredericton, N.B.—The Publicity Committee, comprising five members of the Board of Trade and five members of the City Council, met recently in the Board of Trade rooms and organized for the year. C. Fred Chestnut is to continue as chairman and Ald. Lemont, treasurer of the Board of Trade, will act as treasurer of the committee.

Prince Albert, Sask.—The annual meeting of the Board of Trade was held on Feb. 5, and the following officers were elected: President, T. J. Agnew; vice-president, R. H. Hall. Executive Committee—J. W. Garrett, C. F. Clare, P. W. Mahon, H. Sibbald, A. L. Mattes, B. W. Wallace, T. Williams, J. E. Bradshaw, W. D. Mitchell, J. B. Kernaghan, A. E. Fox, J. Sinclair, J. E. Evans and T. B. Sharpe.

$650 for Leaky Roof.—The Canada Malleable Iron Co. Owen Sound, Ont., sued for $5,000 for a faulty roof put on its new buildings. It was said that the machinery installed was ruined by leaks. Mr. Justice Britton has given judgment for $500 against the Asbestos Mfg. Co. of Montreal, who supplied the material, and against Creeper & Griffin of Owen Sound, for $150 for faulty workmanship.

Installing New Shell-Making Machinery.—New machinery, consisting of nine turret lathers, is being installed by the Canadian Locomotive Co., Kingston, Ont., for the purpose of machining shrapnel shells. At present the Canadian Government is supplying the forged shells ready for machining, but it is reported that the local firm is about to purchase equipment to do the forging as well.

Army Wagons.—A sample of the new army wagon, built for the Canadian Government by the Tudhope-Anderson Co., Orillia, Ont., has been on exhibition at Messrs. E. F. Cooke & Son's warerooms. It is a particularly strong vehicle, weighing 1,600 pounds, with three-inch tires, and has numerous fittings not found on the ordinary wagon. It is rumored there is prospect of further orders for war wagons.

Poisoned Shells.—Sir William Ramsay states on the authority of an eminent French chemist that the German high-explosive and shrapnel shells contain mixed with their charge a considerable proportion of a compound of phosphorus.

The bullets of the shrapnel have been roughened, apparently intentionally, in order to convey this phosphorus to the wounds. Phosphorus conduces to mortification and favors the growth of tetanus bacilli.

Canada Car Co. War Orders — In moving the adoption of the report at the recent annual meeting, Senator Curry said he was sorry that the report was not a better one, but under the circumstances and considering business conditions generally he thought they should feel well satisfied with the showing. Reference was made to war orders aggregating about $2,000,000 which the company now had and still larger ones were looked forward to.

Ross Rifle Co. Orders —The Ross Rifle Co. is one of the principal beneficiaries of the war. The official memorandum shows that an official order was given for thirty thousand rifles, a second for twenty thousand, and it is understood a third is being placed for a similar number. The price paid is $26.90 for each rifle without screw elevating sights. The sights cost $1.10 each, bayonets $5.22, and rifle chest $8.25. The total order so far is thus around $2,800,000.

Quebec, Que.—The Board of Trade at its annual meeting re-elected its retiring officers as follows:—President, Jos. Picard; vice-presidents, J. G. Scott and O. W. Bedard; treasurer, W. J. Banks; secretary T. LeVasseur. Board of Arbitration—Sir Geo. Garneau, Hon. Geo. E. Amyot, M.L.C., Sir. Wm. Price, Messrs. John T. Ross, Wm. Power, M.P., Naz. Fortier, Gaspard Lemoine, W. M. Macpherson. J. T. Martineau, Jos. Winfield, M. Joseph and G. A. Vandry.

Saddlery Orders.—A $250,000 contract for the manufacture of saddlery and other leather equipment for the French Government has been awarded to J. E. Edwards & Sons, leather goods manufacturers, Christie street, near St. Clair avenue, and branch offices at 56 Colborne street, Toronto. The staff at the Edwards factory has been practically doubled, and it is expected that the French contract, with other work on hand, will keep all employed till the end of May. The Edwards factory is one of the chief industries of the Bracondale-Wychwood district.

Medicine Hat, Alta.—The newly elected officers of the Board of Trade are:—President, R. P. Stewart, manager of the Alberta Clay Products Company; vice-president, George E. Armstrong, manager of Ogilvie Flour Mills; secretary, S. E. McClennan. Executive Council—R. H. Kent, J. H. Taber, A. J. Matthews, E. Berrhein, H. H. Brown, E. W. Staney, Dr. W. H. MacDonald, Dr. Woodland, W. Rutherford, A. J. Lepage, G. W. Elliott, I. Bullivant, H. Shardlow, A. McPherson, R. B. Davidson, W. J. Nesbitt, J. E. Davies, W. G. Lynch, T. Bell, F. N. Smith.

Nova Scotia Car Co.—At the annual meeting of the Nova Scotia Car Works Ltd., it was stated that the company has urgent claims from creditors and no liquid capital, so that it cannot execute orders which are available. Some 80 per cent. of the creditors have consented to an extension of nine months, and banking assistance can be secured if 90 per cent. of the creditors will agree to the extension. No creditor is to get any preference, and if the company goes into liquidation it will be at the instance of the company and creditors alike. The report showed $61,391 in bills payable, and $54,500 due the bank.

The Turbine Equipment Co., of Toronto, have been awarded , by the Ver Mehr Engineering Co., a further contract for one 1,800 h.p. De Laval multi-stage steam turbine, which will be connected through the medium of De Laval double helical reduction gears to one 1,200 k.w. 90 per cent. p.f., 3-phase, 25-cycle, 2,200-volt, 500 r.p.m. alternator of the Lancashire Dynamo & Motor Co. make. The steam turbine will operate at a speed of 3,600 r.p.m., and the gear ratio will, therefore, be approximately 7.2 to 1. The contract calls for complete installation at the Toronto Island filtration plant, along with a C. H. Wheeler parallel flow jet condenser, with centrifugal removal pumps and Thyssen centrifugal air pump.

Patent Suit Decision.—The patent suit brought against the B. F. Sturtevant Co. of Boston by the Sirocco Engineering Co., which has been in the courts for the past six years, has just been decided by the United States Circuit Court of Appeals for the second circuit, in favor of the Sturtevant Company. It was claimed that the Sturtevant multivane fan infringed the Sirocco Co.'s patents, and in the Lower Court this claim was sustained. The Court of Appeals, however, reversed the former decision and held that there was no infringement. The Court of Appeals further decided that the Sirocco patents in suit were void in view of the development of the fan-building art prior to the alleged inventions upon which these patents were based.

Making Shells at Midland, Ont.—The plant at Midland formerly known as the Georgian Bay Engineering Works, and which has been standing idle for nearly fifteen months, has been leased by Drummond Bros., who will fit it up for the manufacture of shrapnel shells. The special machinery has already been purchased and will probably be installed in the course of a month. It is expected sixty men will be employed when the plant is in operation. Of these sixty a considerable number will require to be skilled mechanics, and in all probability will be brought in from outside; but the firm will employ Midland labor as far as possible. The business will be under the management of J. J. Drummond, and the firm name will be that of "The Zenith Co. of Montreal," with Drummond Bros. sole shareholders.

Wanted $2,000,000 Profit.—The Carbon Steel Co., of Pittsburgh, on Feb. 15 refused, it is reported, a $4,000,000 war contract to manufacture 1,000,000 three-inch shells for the British Government. The reason is said to be that a big steel broker in Montreal tried to make a $2,000,000 profit on the contract. The Carbon Steel Co. had tentatively agreed to take the contract at this price, when it was ascertained that the Canadian contractor was to get $6 each for the shells. This attempt to "scalp" $2,000,000 angered the Pittsburgh people and they withdrew from the transaction. Some unpleasant exposures of the methods of certain Canadian manufacturers and war supply brokers is threatened. The attempt of this particular beneficiary of the British Government would probably have succeeded but for President Charles McKnight, of the Carbon Steel Co. He returned from England only a few days ago, and while in London got some information as to the contract. He knew to whom it went and the price the British War Office had agreed to pay for the shells. When he arrived in Pittsburgh in Wednesday and was informed of the contract his concern had undertaken, some sharp telegrams were exchanged, with the result that the contract was canceled

Personal

Wm. M. Weir, of Montreal, has been elected president of the Canada Foundries & Forgings Co., Ltd., Brockville, Ont., in succession to John McGill, resigned.

J. P. Cotter, manager of the Canadian Ingersoll Rand Co. for the Maritime Provinces and Newfoundland, has returned to Sidney, C.B., from a business trip.

C. Hamilton-Wickes, His Majesty's Trade Commissioner to Canada and Newfoundland, left Montreal on Feb. 3, by the Maritime Express, en route to the United Kingdom.

D. Lorne McGibbon has resigned the presidency of the Canadian Consolidated Rubber Co., of Montreal, in order to de-

vote more time to the affairs of the Ames-Holden-McCready Co.

C. R. Burt, for the past year and a half factory manager of the Russell Motor Car Co., Toronto, has been appointed assistant general manager and elected to the directorship made vacant by the resignation of Mr. J. E. Rogers. The appointment is effective at once.

James Crawford, of Belfast, Ireland, who has been in Canada looking for supplies of flax fibre for Irish linen mills, says that the growing of flax should prove a profitable business in Ontario.

J. L. Pollock, at one time sales manager of the Stuart Machinery Co., and more recently president and manager of the Alberta Rolling Mills, Medicine Hat, will return to the Stuart Machinery Co. as manager.

H. E. Gainsworth, advertising manager of the Wm. B. Pierce Co., of Buffalo, N.Y., has resigned his position to accept the advertising and sales directorship of the General Specialty Co., Buffalo, N.Y.

Frederick W. Stobart, who has represented the British War Office as purchasing agent in Canada since last fall, has resigned from that office and left for his home in England. A. C. Billing, managing director of Stobarts, Limited, of Winnipeg, succeeds Mr. Stobart. Mr. Billing, has been associated in the work of purchasing supplies in Canada since the establishment here of a branch purchasing office of the Imperial Government.

W. G. McIntosh, B.A.Sc., has recently been appointed sales-engineer for Toronto by the Herbert Morris Crane and Hoist Co., Ltd. Mr. McIntosh is an honor graduate in mechanical engineering of the University of Toronto, and has had considerable office, shop and field experience, having been formerly connected with the Otis-Fensom Elevator Co., the Toronto Power Co., the Canada Foundry Co., and the Dominion Bridge Company.

Tenders

Toronto, Ont.—The Board of Control has extended the time for receiving tenders for the new incinerator, to be located on the Don Esplanade, south of Gerrard Street, until Feb. 23.

Thornbury, Ont.—Tenders will be received up to February 25 for work, material, plumbing, heating and ventilating and excavating for new addition and remodelling the Thornbury Public School. Plans and specifications may be had from T. G. Idle.

Windsor, Ont.—The City of Windsor has for sale and invites tenders for the purchase of machinery and electrical apparatus, consisting of engines, boilers, heaters, steam pumps, shaft, pulleys, belts, generators, arc lamps, switchboard, quantity of copper wire, etc. Complete specifications may be obtained by application to undersigned by whom tenders will be received up till Tuesday, March 2nd. M. A. Dickinson, Acting Clerk.

Ottawa, Ont.—Tenders will be received by R. C. Desrochers, secretary of the Department of Public Works, Ottawa, until March 1st, for the following supplies for Departmental dredging plants in Nova Scotia and New Brunswick: Brooms and brushes, chain, hardware, hose, oils and greases, packing, paint, paint oils, etc., manilla rope, wire rope, steam pipe, valves and fittings. Specification, etc., at the offices of J. K. Blenkinsop, Supt. of Dredges, St. John, N.B., and the Department of Public Works, Ottawa.

CAPTURING GERMAN TRADE.

A great deal has been written of late as to "capturing" enemies' trade—much of it sense, but still more of it nonsense. Many dillettante commercial experts, who have probably never been inside a factory and who have no practical knowledge of how trade and industry are financed and conducted, freely lavish allegations as to lack of initiative and out-of-date methods on the part of our manufacturers and exporters, and airily discuss the "capture" of the export trade of Germany and Austria-Hungary, valued at over six hundred millions sterling per annum. We have no desire to discourage energy and enterprise in making the most of every opportunity for extending our trade—far from it—nor is it denied that in some directions our methods of business are capable of improvement, but to spread broadcast throughout the world the idea that our trade and industry is conducted on out-of-date principles is not only untrue, but is calculated to defeat the object which, presumably, such critics have in view. Up to now it has not been possible to do a great deal more than to survey the field and to pave the way for strenuous competition at the right moment, and much assistance in this direction has been afforded by the British Board of Trade, the London Chamber of Commerce and the Department of Trade and Commerce, Ottawa.

Ottawa, Ont.—Tenders will be received until Thursday, February 25, 1915, for the installation of one (1) standard passenger elevator, and one motor generator set to supply current for elevator, in the examining warehouse, Fort William, Ont. Plans, specifications and form of contract can be seen and forms of tender obtained on application to the department of public works, Ottawa, at the offices of Thos. A. Hastings, clerk of works, Postal Station "F," Toronto, Ont., and to J. C. Stinson, architect, Fort William, Ont.

Hamilton, Ont.—Sealed tenders will be received by the chairman Board of Control, City Hall, up to Monday, March 1st, 1915, for the supply of the following material and equipment:—Castings, (ordinary and special) iron pipe, hydrants, valves, extension boxes, hardware, lead pipe, pig lead, rubber hose, rubber boots, road oil, flux, fuel oil, coal oil, gasoline, concrete and garbage duck covers, brass brooms and sectional sweepers, brass work for water department, sewer brick. Specifications can be obtained at the office of the secretary of the Works Department. S. H. Kent, City Clerk.

Toronto, Ont.—The undersigned has been instructed to offer for sale the following:—

Parcel I.—The steamers "Meteor," "Temiskaming" and "Jubilee," with their equipment, the hull of the launch "Kiask," five scows, certain wharf properties, freight sheds and shipway at points on Lake Temiskaming and certain miscellaneous equipment, the whole being the property of the Temiskaming Navigation Company, Limited; and

Parcel II.—The steamer "Silverland" and her equipment, being the property of the Haileybury Navigation Company, Limited.

Tenders for the above will be received by the undersigned up to noon of Wednesday, the 10th March, 1915. James Hardy, assignee for benefit of creditors of Temiskaming Navigation Co., 15½ Toronto Street, Toronto, Ont.

Contracts Awarded

Ottawa, Ont.—The Dominion Bridge Co., Ltd., has been awarded the contract for a number of traveling cranes for the N. T. R. Locomotive and Car shops at Quebec.

Winnipeg, Man.—The contract for an engine shed for the Greater Winnipeg Water District line at Deacon, has been awarded to the Progress Construction Co., at $3,997.

Winnipeg, Man.—Hadden & Co. have received a large clothing contract from the British Government, consisting of six thousand tunics and an equivalent number of trousers.

Hamilton, Ont.—Tenders from the Otis Elevator Co., for elevators for the main building of the City Hospital, as a cost of $7,500, were accepted, and also for the Canadian Oil Co., for lubricating oils.

Winnipeg, Man.—The following contracts have been awarded by the Greater Winnipeg Water District:—Canadian-Fairbanks Morse Co., four 15,000 gallon tanks, three pumps and engines, all erected, $7,490.77; Watrous Engine Works, Brantford, rock crushers, $1,220; Vulcan Iron Works, Winnipeg, revolving screen, $1,071; Manitoba Bridge & Iron Works, three elevators, $1,373; Stewart Machinery Co., three conveyors, $1,023; City of Winnipeg, for a 100-125 h.p. steam engine steam boiler with stack, steam feed pump with accessories for boiler, $1,894; also deep well pump, $141; Browning Co., Winnipeg, portable crane excavator, $7,427; Montreal Locomotive Works, four locomotives, $43,000.

Building Notes

Toronto, Ont., Malvern high school is to be enlarged at a cost of $70,000.

Hamilton, Ont.—Land has been purchased at a cost of $7,000 for the building of a labor temple here.

Berlin, Ont.—An addition is to be erected to the Berlin Public Library this year at a cost of approximately $20,000.

Toronto, Ont.—The new Jarvis Collegiate, for which plans and estimates are under preparation, will cost in the neighborhood of $300,000.

Toronto, Ont.—Plans are being prepared for the proposed central courts building which will also be police headquarters. It will probably cost over $750,000.

Toronto, Ont.—It is proposed to add three stories to the old Board of Trade Building, and reconstruct the interior. In the future it will be known as the Transportation Building.

Toronto, Ont.—The Butterick Publishing Co., of New York, will build a factory on Wellington Street, near Spadina, at an estimated cost of $100,000. L. S. Yolles is the architect.

Chatham, Ont.—The plans and specifications for the new sub-station for the hydro distributing system, to be erected on King Street, have arrived here from Toronto, and tenders will be called at once.

Toronto, Ont. — Estimates totaling $355,000 for high school buildings were adopted. The chief item was $250,000 for a Central Collegiate Institute, to be erected on the north side of East Bloor street.

Toronto, Ont.—Tenders have been received by the Ontario Hydro-Electric Power Commission, Continental Life Building, Bay street, for a station and office building to be erected by the Public Utilities of Chatham, Ont.

Toronto, Ont.—Building estimates aggregating $1,615,000 for high and public schools have been presented by Superintendent Bishop to the Property Committee of the Board of Education, and were given general approval. They will have to pass the Finance Committee of the board.

Montreal, Que.—Tenders for the construction of the civic library, to be built on Sherbrooke St. East, between Montcalm and Beaudry Streets, are to be called at once, in accordance with a resolution of the Board of Control passed on January 30. All tenders must be submitted by February 25. Mr. Payette is the architect.

Guelph, Ont.—Tanner & Tanner, architects, have completed plans of a new garage building for J. H. Johnston, of this city. It will be one storey, situated on the south side of Cork Street, and will have foundations of sufficient strength to carry two additional storeys at any future time. This garage will have a floor area of six thousand square feet.

Railways-Bridges

Toronto, Ont.—Work in connection with the Bloor street viaduct has been commenced.

Uxbridge, Ont.—It is now certain that the ratepayers of this township will be given the opportunity within a comparatively short time to vote again on Sir Adam Beck's scheme of hydro radials.

Niagara Falls, Ont. — Alexander Fraser, of this town, has given notice that he will apply for the incorporation of the Ontario Niagara Connecting Bridge Co. with power to build a bridge over the Niagara River.

Toronto, Ont.—Works Commissioner Harris now estimates that the cost of the St. Clair avenue bridge to extend that street in a straight line to Moore Park will cost $345,000, ten thousand dollars more than last year's estimates.

Toronto, Ont.—The Board of Control have decided to ask the Legislature to compel the Toronto Street Railway to carry out the recommendations of the Barnes report. The extensions and equipment suggested would cost the company $2,000,000.

Ottawa, Ont.—R. A. Pringle, in his report, states that the true, actual and proper cost of the construction of the Southampton Railway was $202,565, or $15,950 per mile instead of $291,517, or $22,954 per mile, as certified by E. V. Johnson, inspector engineer.

Three Rivers, Que.—The voting on January 25, relative to the franchise of twenty years to the Three Rivers Traction Co., resulted in a majority of four hundred and six votes in favor of granting the franchise. Three Rivers will, therefore, have a trolley line in the near future.

Hamilton, Ont.—The civic officials have decided to apply to the Ontario Railway Board for an order compelling the Street Railway Co. to build the two cross-town lines proposed, renew its York Street and West King Street tracks, and better its service unless the company officials decide to meet the demands of the city in the matter.

Ottawa, Ont.—The Simcoe, Grey and Bruce Railway Co. will apply to Parliament for an Act extending the time within which to commence the construction of the railway and expend 15 per cent. of capital stock for two years, and for permission to complete the railway and put it in operation within five years after the passing of the Act.

Toronto, Ont.—The Ontario Railway and Municipal Board has extended the time to July to the Toronto Street Railway for the reconstruction of the 13.6 miles of track ordered some time ago by the board. Application failed, however, to get more time for the fifty new cars which were ordered for June 1, and the Ossington avenue extension.

Widen Montreal Tunnel.—Sir Donald Mann, vice-president of the C. N. R., states that the tunnel under Mount Royal in Montreal will be extended to its full two-track width from Mount Royal down to the Dorchester Street station site by the end of April next, at the present rate of progress. Sir Donald expects to have the station completed during the summer or the early autumn.

Ottawa, Ont.—In a statement given out after its annual meeting, the Ottawa Traction Co. (Ottawa Electric Railway) announces gross earnings for the year as $1,096,459. The number of passengers carried was 25,321,547, an increase of 1,333,664 over the preceding year. The

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

amount of net earnings and dividends is not disclosed. The directorate was re-elected, with T. Ahearn as president and W. Y. Soper as vice-president.

Ottawa, Ont.—According to the annual report of the Transcontinental Railway Commission presented by Hon. Frank Cochrane on Feb. 8, the total expenditure on the road to the end of the last fiscal year was $142,867,999, exclusive of interest and the cost of the Quebec bridge. When track laying was completed in November, 1913, there were 1,803 miles of main line, 20 miles of double track and 423 of sidings.

Ottawa, Ont.—An agreement between the city and the J. B. Strauss firm, of Chicago, for the preparation of plans for the Ottawa East bridge is to be drawn up, and if approved of by the engineer of the Department of Railways and Canals, sent to Chicago for execution. On the advice of the city engineer, the Board of Control has decided to accept the offer of the Strauss firm for preparing the plans and acting as consulting engineers, the fee for this to be $5,600.

Ottawa, Ont.—While developments are not anticipated for some time in regard to the lease by the G. T. P. of the eastern division of the N. T. R., there is little likelihood that the Government itself will be forced to operate the line. If the Grand Trunk fails to implement its contract of lease it is intimated here that another company representing wealthy Canadian interests would be formed and be prepared to take over the line on the same terms as are embodied in the G. T. P. contract.

New Niagara Bridge.—President Wilson has signed the Gittins bridge bill, authorizing the Ontario-Niagara Connecting Bridge Co. to build a bridge across the Niagara river north of the Niagara Falls city line. A bill authorizing the building of the bridge will be introduced in the Canadian House of Commons early in the session that is about to begin. The bridge company is authorized to build a bridge for pedestrians, vehicular, steam and electric railroad traffic, and for the carrying of telephone, telegraphic and electric wires over the river. The Mackenzie-Mann syndicate is interested in the bridge company and it is said that the proposed bridge will either afford an entrance to the United States for a new trolley road from Toronto, or for the C. N. R. The company plans the building of a line from Lockport to the Falls, connecting both cities with the new bridge.

Wood-Working

Dundas, Ont.—The Brown & Liddy Co., will establish a box factory here.

Strathroy, Ont.—The head office of the Canadian Handle Mfg. Co. will be located here instead of in London.

New Westminster, B.C.—The Superior Sash & Door Co. factory was destroyed by fire on February 6. The damage is estimated at $100,000.

Westport, Ont.—The Wm. Dier Co., carriage factory was destroyed by fire recently. The damage is estimated at $3,000, part of which is covered by insurance.

New Incorporations

The Beaver Oil & Gas Co. has been granted letters patent to operate oil, gas and mineral lands, etc., within the Counties of Essex, Kent, Elgin and Lambton, Ont.

Ottawa, Ont.—The Chatham Packing Co., of Chatham, Ont., has been incorporated to take over the business of the O'Keefe & Drew Abattoir Co. The capital is $400,000.

The Canadian Shirt and Overall Co. has been incorporated at Winnipeg to manufacture Clothing. The capital of the company is $60,000, and head office at Winnipeg, Man.

The Lloyd Mfg. Co. has been granted a license to carry on the business in Ontario of making metal wheels, wire-working machinery, etc. M. K. Cowan, of Toronto, has been appointed attorney.

Canada Universal Nut Lock, Ltd., has been incorporated at Toronto, Ont., with a capital of $100,000, to manufacture nut locks at Toronto, Ont. Incorporators—J. M. Robinson, J. Booth and J. D. Blissett, all of Toronto, Ont.

The Middlesex Mills, Ltd., has been incorporated at Toronto, Ont., with a capital of $80,000 to manufacture linens, cottons, silks, etc., at London, Ont. Incorporators: W. J. Teasdall, F. Barnett and Albert Mitchell, all of London, Ont.

Leather-Canvas-Textile Mfg. Co. has been incorporated at Ottawa, Ont., with a capital of $50,000, to manufacture leather and canvas goods, etc., at Ottawa, Ont. Incorporators—R. G. Code, E. F. Nurritt and J. R. Osborne, all of Ottawa, Ont.

The Kaufman Rubber Co. has been incorporated at Ottawa, Ont., with a capital of $2,000,000, to carry on business in rubber and rubber products at Berlin, Ont. Incorporators—J. Kaufman, M. R.

Kaufman, and A. R. Kaufman, all of Berlin, Ont.

Baird & Howie, Ltd., has been incorporated at Fredericton, N.B., with a capital of $24,000, to take over the business of Baird & Howie, engineers and contractors, of Fredericton. Directors are G. F. Baird and George E. Howie, of Fredericton, N.B.

The Pulsetter Co. has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on the business of marine and general engineers at Toronto, Ont. Incorporators: R. Williamson, F. W. Hill and J. P. White, all of the city of Toronto, Ont.

The Gordon Construction Co. has been incorporated at Toronto, Ont., with a capital of $200,000, to carry on business as contractors and engineers at Niagara Falls, Ont. Incorporators—G. Gordon, J. L. Dawson and G. H. Dawson, all of Niagara Falls, Ont.

The Sarnia Creamery Co. has been incorporated at Toronto, Ont., with a capital of $40,000, to manufacture ice cream and ice, and to operate cold storage plants at Sarnia, Ont. Incorporators—N. LeSueur, A. I. McKinley and L. Telfer, all of Sarnia, Ont.

Catalogues

Belting.—The Canadian Fairbanks-Morse Co. have arranged to carry a large stock of all the well-known brands of belting made by the Graton & Knight Manufacturing Co.

Twist Drills.—The supplement to catalogue No. 8 issued by the John Morrow Screw & Nut Co., Ingersoll, Ont., is devoted to twist drills. The various styles are illustrated and the price and other particulars of each size given.

Goggles.—Eye protectors of various styles are described in a bulletin issued by T. A. Willson & Co., Inc., Toronto. Each style varies to suit particular requirements, and illustrations are given of each, accompanied by a brief description.

Dwight Slate Marking Machines, manufactured by the Noble & Westbrook Mfg. Co., Hartford, Conn., are described in a catalogue recently issued. Both power and hand-operated machines for placing on flat or round metal surfaces impressions of trade marks, patent dates, graduated scales, etc., are featured. Full particulars are given of each type of machine, including capacity, shipping weight and price. A number of sample marks and illustrations show the wide range of application, while a list of users is also included.

HINTS TO BUYERS

GEARS

CUT GEARS

HAMILTON GEAR & MACHINE CO.

Cor. Concord & Van Horne

TORONTO

Cut Gears only—
The rough moulded kind are obsolete.

Chicago Steel Bending Brakes

We are exclusive Manufacturers of Steel Bending Brakes, and our product shows it.

10 ft. for 10 Ga.

Only about three - horsepower is required to operate this brake full capacity.

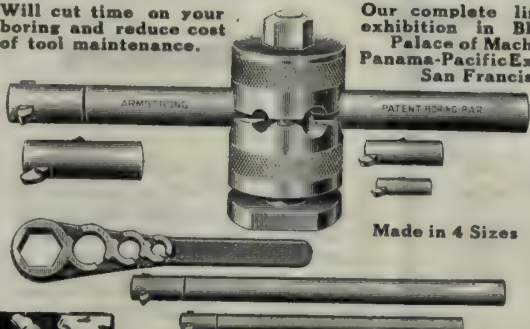
Catalog giving full description mailed upon request.

The Steel Bending Brake Works, Ltd., Chatham, Ontario

THE ARMSTRONG 3-BAR BORING TOOL

Will cut time on your boring and reduce cost of tool maintenance.

Our complete line is on exhibition in Block 41, Palace of Machinery, Panama-Pacific Exposition, San Francisco.



A Modern High Speed Tool

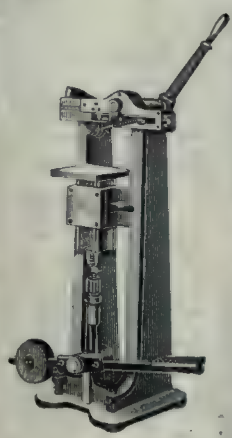
Made in 4 Sizes

Catalog for the Asking

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
306 N. Francisco Avenue, Chicago, U.S.A.

DWIGHT SLATE MARKING MACHINE

TRADE MARK



For Marking Shrapnel Shells

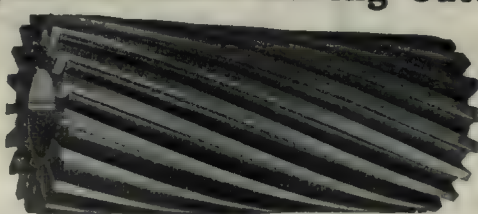
or they will mark any article, either round or flat. Power or Hand Machines recommended.

Steel Stamp and Die Cutting by expert engravers.

Send for Catalogue.

Noble & Westbrook Mfg. Co.
Hartford, Conn., U. S. A.

Taylor-Newbold Milling Cutters



Inserted Helical Blades of High-Speed Steel, with Constant Rake Angle, Insures Higher Speeds and Heavier Cuts.

May We Send Bulletin R-P?

THE TABOR MANUFACTURING COMPANY
PHILADELPHIA, PA., U.S.A.

¶ We know of a case recently where an advertiser received an inquiry from a small advertisement in

Canadian Machinery

¶ This inquiry resulted in an order, the profit on which will pay for the advertisement for two years.

"THE INTERNATIONAL LIMITED"—GRAND TRUNK RAILWAY SYSTEM, MONTREAL AND CHICAGO.

The object of an apprenticeship system is to provide a supply of well-trained mechanics, foremen, and staff officers who can be relied upon to go ahead with and carry out efficiently and successfully productive work in a particular sphere of manufacturing and industrial enterprise. It has been found from experience that men so trained become not only a valuable asset to those directly concerned, but are an important contributory factor in the matter of that higher standard general competence, so necessary to manufacturing achievement.

THE Grand Trunk Railway have employed apprentices in their shops and roundhouses for a good many years, but until about fourteen years ago very little attention was given them. The remuneration then was only about four cents per hour and consequently the apprentice had to depend almost entirely upon his parents for support. There were then no evening classes in drawing and mathematics, and apprentices wishing instruction in these lines used to hire their own instructor who oftentimes was none too competent. The only requirement as an apprentice was that the applicant be fifteen years of age, no attention being paid to his mental or physical condition or other qualifications.

About the year 1901, considerable developments were taking place in railroad shop practice, requiring as a result a more intelligent class of mechanics and foremen, and the G. T. R. decided from then on to give more time and attention to the training of their apprentices. Already a school had been opened at one of the large shops and evening classes started. The instruction was not only free, but it was compulsory for every apprentice to attend. Similar schools were organized at the other large shops. These schools had no connection with the Government or other educational institution, but were controlled and operated entirely by the company.

Trouble, however, soon arose with the apprentice material to be dealt with. A majority of the boys had been careless with their day-school education, merely idling away their time until the law permitted them to learn a trade. As a remedy, every future applicant was required to pass an examination, and to do so called for the fair degree display of a common school education. For a while, a large number of the applicants had to be rejected but there was obtained the desired effect, namely, that boys to enter the shop must go to school longer and pay more attention to their studies. As an ultimate result, the educational standing of the apprentices was increased fully fifty per cent.

E. J. CHAMBERLIN,
President, G.T.R., System.

Such excellent results were being obtained from the educating of their own workmen that W. D. Robb, superintendent of Motive Power, decided to put this apprenticeship system in force throughout the whole of his department, and to, if possible, still further increase its efficiency. He supervised the publication of textbooks which have been the foundation for the editing of better ones. He also introduced the system of annual examinations, giving prizes to the best students. Thus, by using the same textbooks and having the same annual examinations, the subject matter taught throughout the system was made standard, and the co-operation of the instructors in discovering the best methods of handling the apprentices was obtained.

Trouble was experienced, however, by apprentices being attracted away during their third and fourth year by manufacturers, but Mr. Robb got over this difficulty to a large extent by having every apprentice indentured. The effect of this and other changes to keep boys in service is brought out clearly in dia-

The author of this article is a student in Mechanical Engineering (Class 1915), McGill University, Montreal.

gram No. 1, the class of 1910 being the first to graduate under this new regulation. To Mr. Robb, his chief draughtsman, Mr. Powell, and his staff of capable master mechanics, the Dominion of Canada is more or less indebted for the helping hand the G. T. R. is giving to the solution of the important problem of industrial education. E. Meldrum, supervisor of apprentices, is also taking a large share in the building of the system. Since his appointment to office in 1913, he has surrounded himself with groups of capable teachers, and has revised the text-books, thus raising the efficiency of the instruction to a much higher degree.

To give the reader a more vivid idea of the relative growth of the system at the Stratford shops, Diagram No. 2 was drawn. From this it will be noted that the number of apprentices increased almost twice as fast as the number of employees, and the growth over the whole system has been almost identical with that at Stratford.

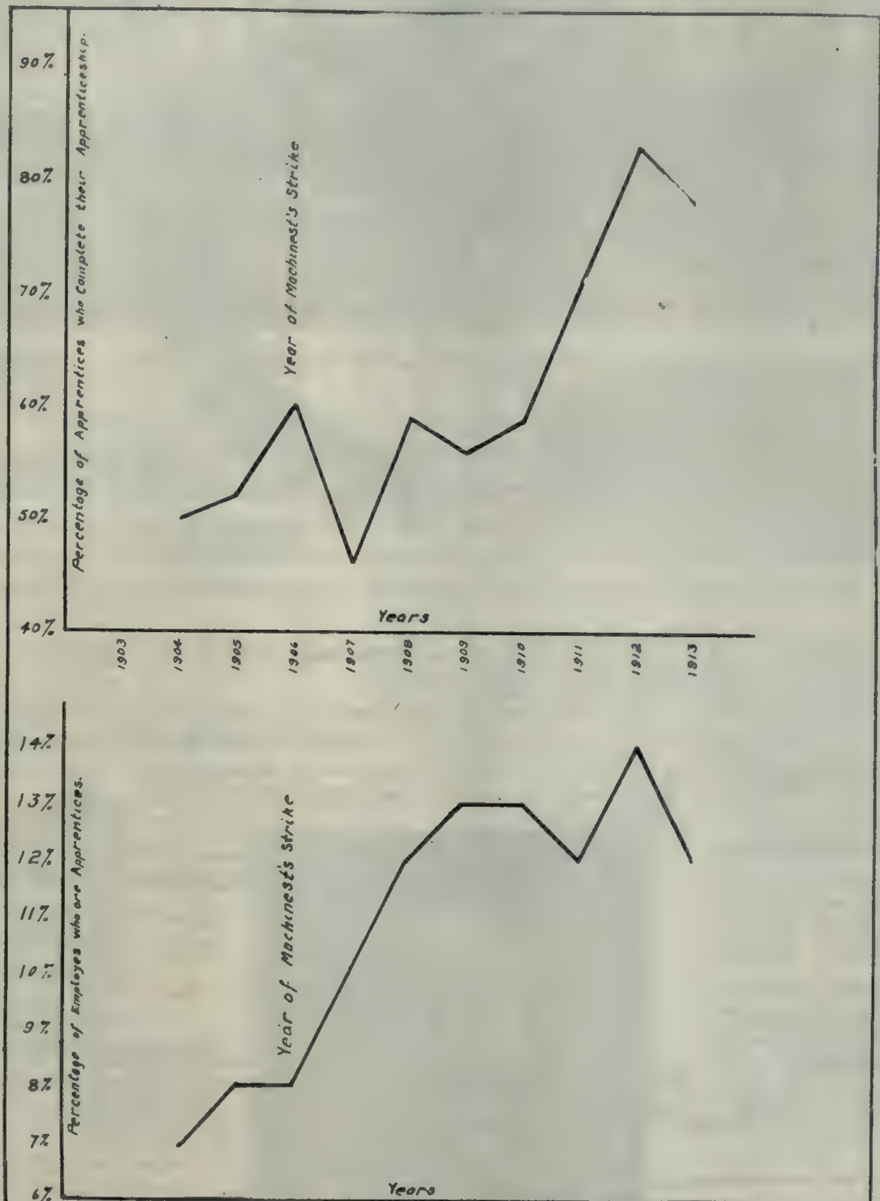


DIAGRAM NO. 1 (UPPER), SHOWING PERCENTAGE OF APPRENTICES AT STRATFORD SHOPS WHO COMPLETE THEIR APPRENTICESHIP.

DIAGRAM NO. 2 (LOWER), SHOWING RELATIVE GROWTH OF APPRENTICESHIP SYSTEM AT STRATFORD SHOPS.

Selecting and Enrolling Apprentices.

The problem of attracting and selecting apprentices is one of the utmost importance, for, without good apprentice material, inferior mechanics are the result. The company may build schools, provide teachers and shop instructors, but, unless the boys are physically, mentally and morally fit, the effort to make skilled mechanics will be in vain.

The G. T. R. realizes the importance of this and, in order to get a supply of applicants from which to choose their class, they advertise their system far and wide. Various means of advertising are used. Articles appear in the technical and other press from time to time, special pamphlets are distributed with the company's general advertising matter, drawings made by the apprentices are shown at the Canadian National Exhibition and other places each year, incidentally carrying off the bulk of the prizes while, in addition, the life of the mechanic socially and in the shops is made as attractive as possible. This last feature appeals perhaps more strongly and to many more boys than any other, and the G. T. R. are to be congratulated upon the successful manner in which they are handling this problem. The following circular, issued each year from the office of the President, and applicable to lines east of the Detroit and St. Clair rivers, serves to attract high school graduates into the company's service, and the numbers tend to increase every year.

Free Scholarships Circular.

Two free scholarships, each covering four years' tuition in the Faculty of Applied Science of McGill University are hereby offered, subject to competitive examinations, to apprentices and other employees of the Grand Trunk Railway Co., under twenty-one years of age, and to minor sons of employees.

The competitive examinations, which will be the regular entrance matriculation examinations provided for in the annual calendar of the University, will be held at the University, Montreal, and at other centres, beginning June 12th, 1914. The two candidates making the highest average and complying with the requirements of admission will be awarded the scholarships, and have the option of taking a course in any department of the Faculty of Applied Science. Scholarships will be renewed from year to year, to cover a period not exceeding four years, if at the close of each session the holders thereof are entitled, under the rules, to full standing in the next higher year.

In case a scholarship holder finds it necessary to interrupt his course for a year or more, notice must be promptly given at the close of the session to the railway company and to the head of the Transportation Department of the University, in order that the scholarship may be open to other applicants. In order to establish prior claim to the next available scholarship, notice of the student's intended return must be given to the Railway Company and to the head of the Transportation Department of the University, not later than January 1st, preceding the opening of the session in

which such scholarship will be available. In consideration of the free scholarships, students will be required to enter the service of the company as student apprentices, and serve during vacation periods while in attendance at the University, and at the option of the company, for two years after completing the college course. Successful candidates will, before entering the University, be required to execute the Company's regular form of student apprentice contract, copies of which can be obtained upon application to D. E. Galloway, assistant to president, Montreal, to whom also applications for certificates entitling eligible persons to enter the competitions should be addressed.

Copies of the annual calendar containing the conditions of admission and announcement of courses may be obtained upon application to J. A. Nicholson, Registrar, McGill University, Montreal.

(Signed) E. J. CHAMBERLAIN,
President.

Apprentice Admission Requirements.

The requirements of admission as an apprentice are not severe but are strictly adhered to. In the case of a desirable applicant failing in part—say the examination in arithmetic, he is allowed to enter the service as a machinist assistant, and is encouraged to make another attempt. The applicant:

(a)—Must be between the ages of 15 and 19.

(b)—Must pass an examination in arithmetic. (Sample paper follows.)

(c)—Must write a letter of application, which serves as an examination in writing and spelling.

(d)—Must satisfy the master mechanic or other official as being suitable to enter the service.

(e)—Must, if his application be accepted, sign together with his parent or guardian, an agreement with the company.

(g)—Must pass a prysical examination conducted by one of the company's doctors.

Arithmetic Examination.

The following is a copy of the arithmetic examination, the time allowed being two hours and the pass marks one hundred per cent.:

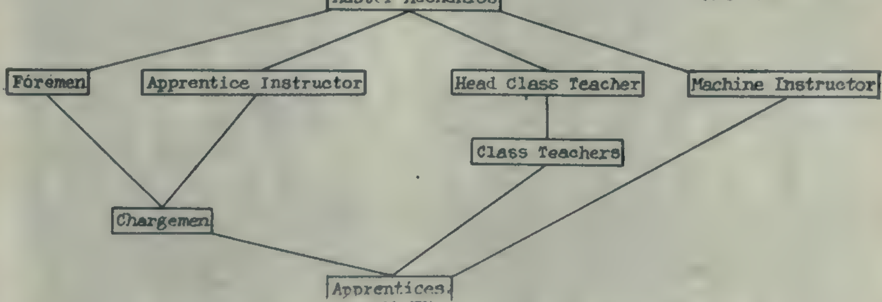
1.—Add 327, 432, 7,893, 45, 32,789.
2.—Multiply 32,695,821 by 49,071.
3.—Divide 845,321,987 by 4,235.
4.—Add 5-32, $3\frac{5}{8}$, 7-16, $\frac{3}{8}$, $4\frac{3}{4}$.
5.—Multiply $4\frac{5}{8}$ by 7 3-16.
6.—Express in lowest fraction .4375.
7.—Express in lowest decimal 7-32.
8.—Multiply 12.728 by .056.
9.—Add 6.42, .321, 82.785,321.8.
10.—Divide 1,472.4284 by 326.48.

Following Acceptance.

When a boy's application is accepted he must interview the master mechanic,

W. D. ROBB,
Supt. Motive Power, G.T.R. System.

who offers him some good advice, warning him against the forming of bad habits, pointing out the necessity of paying strict attention to all the instruction given, and the advantages to be gained by supplementing this with reading



SUPERVISION OF APPRENTICES—ORGANIZATION DIAGRAM.
Where there are only a few apprentices, one man may be apprentice instructor, head class teacher and machine instructor.

and study at home. Entering the shops as an apprentice marks with the average boy a change point in his life. He is perhaps leaving home to board with a stranger, he is passing from a schoolboy to a wage-earner, and is taking a decided step as to his future occupation. Consequently a few words of encouragement from his superior, the master mechanic, a man who has made a life study of the work into which he is now entering, leaves a marked impression upon the young apprentice mind.

Supervision of Apprentices.

The supervision of apprentices is an important problem. Conditions have changed since repair shops were small and when the superintendent was able to take a personal interest in each boy's welfare. To-day the supervising and instructing must be left to a large extent to a special staff of men. The following figure may make clear the organization of the G. T. R. for the handling of apprentices in its motive power department:

The president, being head of the company, is naturally head of the apprentice systems of the various departments such as the motive power department, car department, and transportation department. He especially controls the granting of scholarships to McGill University.

The supt. of motive power is head of the system in his department. He signs all indenture papers on behalf of the company; he authorizes all changes regarding textbooks, examinations, etc., also the method of instructing and promoting of apprentices, and in fact all important changes in the system.

The supervisor of apprentices has charge of the technical and practical instruction of apprentices throughout the whole department. Some of his special duties are: Organizing all schools, assisting the master mechanics to choose their instructors and teachers, outlining the courses of instruction, revising the textbooks when necessary, inspecting all evening classes to see that proper progress is being made, and conducting the yearly examinations. He must see that the class-rooms are being kept in a clean and sanitary condition, and that proper care is taken of the desks, drawing-boards, etc., furnished by the company. The supervisor of apprentices reports direct to the superintendent of motive power.

The master mechanic is head of the apprentices at his own station. He is entrusted with the employing of his own apprentices and instructors. He has to see that the classes are properly conducted and that the pupils are receiving sufficient attention both in the classes and in the shop.

The apprentice instructor is a mechanic employed at each shop who looks after the business end of handling the apprentices and who partially assists in the practical work in the shop. His special duties are the keeping of all records of the apprentices, the promoting of apprentices from one class of work to another, and the conducting of the examination on shop tools and practices (referred to later). With him lies the greatest responsibility, that of keeping the boys contented. To be respected by them he must have a strong personality and must be a man of clean habits, both mentally and physically.

The apprentice machine instructor is an expert machinist employed at all large shops where there are a number of apprentices employed. His whole time is spent instructing in the shop. Besides being a good practical mechanic, possessing the ability to teach what he knows, he must have a good technical knowledge so as to be able to drive home to the apprentices the practical application of problems dealt with in the class-rooms.

The foremen and chargemen are the men directly over the apprentices, and must be obeyed as in the case of other employees. To the chargemen is given the bulk of the shop instruction, and in this respect very little trouble is experienced in getting their co-operation. The foremen and chargemen are held directly responsible for the apprentices' work and progress in the shop, and for this reason more chargemen are employed than if skilled labor were made use of. The chargeman reports to the apprentice instructor on the ability of the apprentices under his care to handle the work in his department.

The head class teachers are to the evening classes what a principal is to a public school. He must see that all his teachers are capable, that the work mapped out for each class is being covered, and that the apprenitces are making the proper progress. The class teachers are draftsmen and practical men from the shop who have a thorough grasp of the subjects taught, and who are capable of teaching these to a class of boys.

The apprentices are divided into two classes, namely, "regular" and "special." The regular apprentices are those who are indentured to learn a trade and who receive their school instruction from the company. They are divided in groups according to the trade they are learning. The following are the trades offered and the corresponding terms of apprenticeship:

ROBERT PATTERSON
Master Mechanic, G.T.R. Shops, Stratford, Ont.

Machinist and fitter, 5 years.
Boilermaker, 4 years.
Blacksmith, 4 years.
Tinsmith and pipefitter, 4 years.
Patternmaker, 4 years.
Moulder, 4 years.
Electrical, 4 years.

APPRENTICES AT STRATFORD SHOPS, JULY, 1914—SOME OF THE NUMBER ARE HIGH SCHOOL GRADUATES.

Special apprentices are those who are attending some recognized engineering college and who have signed the student apprentice agreement with the company. Apprentices and sons of employees who have obtained a G.T.R. scholarship to McGill University are classed as special apprentices.

Ninety-two per cent. of all apprentices are machinist and fitter apprentices and consequently in this essay where space is limited, whenever the system varies for different groups of apprentices, only the case of the machinist apprentice will be dealt with. The requirements for admission and the school instruction is the same for nearly all apprentices, but the shop instruction is naturally different.

Shop Instruction.

For a machinist and fitter apprentice, the shop instruction is spread over a period of five years. From six to eight months of this time is spent in one of the "outer" shops, such as the smith-shop, pipe-shop, or boiler-shop; about thirty months is spent in the machine-shop; and the remainder of the time in the erecting shop.

As far as possible a regular system is followed in moving apprentices from one class of work to another, but in some cases the instructor must be guided by his own judgment and by the ability of the apprentice. The following shop schedule will give the reader a fair idea of the opportunities afforded the average machinist apprentice to learn his trade.

General Work.

Steam hammer in smith shop, helper to pipefitter, or rivet boy in boiler shop, 8 months.

Machine Shop Work.

Nut-facer, screwing machine, or centering machine, 6 months.

Drills, 4 months.

Slotter, miller, or boring mills, 4 months.

Shaper or planer, 4 months.

Lathe, 6 months.

Bench work on rods, motion, air brake, etc., 7 months.

Drafting.

Drawing office, 2 months.

Erecting Shop Work.

Re build gang, 4 months.

Eccentric gang, 3 months.

Shoe and wedge gang, 3 months.

Steam pipe gang, 3 months.

Guide-bar and valve gang, 3 months.

Pit gang (frames, motion, spring gear, etc.), 6 months.

Total, 5 years.

The work in the "outer" shops, although, strictly speaking, not pertaining to the machinist's trade, yet is of great value to the company, and is beneficial to the boys, by reason of the better, all-round training they acquire. In the smith shop the apprentice has an excellent opportunity to look around and get a good general idea of the various forging operations which will often be useful in after life. By working in the pipe-shop the boy becomes thoroughly acquainted with the locomotive, as his work lies not only in the shop but also on the test track. The boy in the boiler shop gets an excellent insight into the construction of a boiler and how it is repaired. In fact, it is a common regret among graduate apprentices, more especially those who are working in round-houses, that they had not paid a little more attention to what was going on around them during their stay in these shops.

In the machine shop the boy is first put on a small, simple machine and then on more difficult ones. No machine is considered too good or any bench work too accurate for a bright apprentice. For example, in the tool-making department usually thirty to forty per cent. of the employes are apprentices. In this connection, the following data, taken from the records at one of the large shops will be interesting:—

50 per cent. of the lathes are run by apprentices.

50 per cent. of the shapers are run by apprentices.

30 per cent. of the planers are run by apprentices.

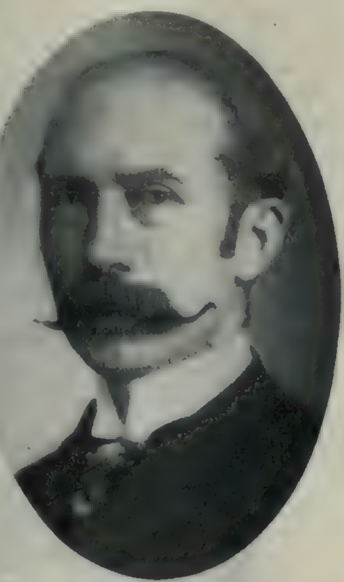
75 per cent. of the drills are run by apprentices.

In the erecting shop, the work of building the locomotives is divided among various gangs of men, and nearly every apprentice is given several months' work in each of these gangs. One gang in particular, called the "rebuild gang," is composed almost entirely of apprentices, and is an excellent place for an apprentice to develop self-confidence in going ahead with new work. As a rule, a boy must work with a skilled mechanic until he can show his ability to work alone or with another apprentice.

In all these shops or departments, the instructing is done first by the chargeman or gang foreman, and later by the apprentice instructor. The spirit of independence is encouraged among the students thus giving a much better training than if the demonstrator was always at his right hand to help him with the least difficulty and to do the thinking for him. The efficient piece-work system in vogue in the shops greatly encourages the boys to do their work quickly, thus giving them a training essential to the making of good machinists.

Text-book Instruction Feature.

The instruction in the shop is supplemented by a text-book, which is presented to each boy as soon as he enters the service. The book is made up of a series of questions and answers and is thus practically self-instructing. It is divided into five parts, one for each of the five years. The first part consists of seventeen questions and answers on drilling machines, their care and tools used. The second part deals partly with shaper and planer practice, and partly with lathe practice. Part three treats on screw-cutting with lathes, forced fits, and cutting speeds for lathe work. Part four deals partly with bench tools such as chisels, files, etc., and partly with



JAMES POWELL,
Chief Draftsman G.T.R. Headquarters Shops Point St. Charles, Montreal.

erecting work such as fitting a cylinder head, putting up guide bars, etc. Part five explains main and side rod practice, laying off eccentric keyways, squaring an engine, and running over the valves. Great pains have been taken in selecting the material for this book and in presenting the topics in a simple style.

At the end of each year the apprentice must pass an examination on part of this book, and also must make a drawing of a model. Failure at the first attempt in either of these examinations means two months' work without the increase in pay, promised at end of each year, and failure the second time means expulsion from the service. For other groups of apprentices, the shop instruction and text books are similar.

School Instruction.

The school instruction is the same for all regular apprentices and is given gratis by the company. The class rooms and equipment, text books and drawing supplies are furnished by the company, with the exception of drawing instruments, which are sold to the apprentices at wholesale prices.

The classes are held in the evening and attendance is compulsory for every regular apprentice. If this attendance rule were not in force, only the more ambitious boys would take advantage of the opportunity, and to make the system a success the company must formulate its rules to cope with the average boy. There are two classes a week for six months in the year, which is equivalent to one hundred hours a year. One-half the time is devoted to mechanical drawing and the other to practical mechanics.

The course in mechanical drawing in the past consisted chiefly of copying drawings from blue prints. The elementary geometrical constructions used in drafting were first dealt with and then the student was given a simple drawing to copy, which was followed by harder and harder drawings, until in the fifth year a quite complicated drawing was attempted. The teachers spend their time going from one apprentice to the other showing them how to use their instruments and pointing out the principles of mechanical drawing, lectures being given from time to time upon drafting room methods and standards. At the end of each class session an examination was held, which was a test of the student's skill to copy a drawing in a limited time.

This method of teaching did not prove altogether successful. The boys became skilled in using their instruments but were not made familiar enough with the underlying principles of mechanical drawing. The average graduate was not as proficient as a mechanic should be in reading a blue print quickly and accurately, and in making a sketch of a piece of machinery. So, in October, 1914, when the classes started again, another method was adopted.

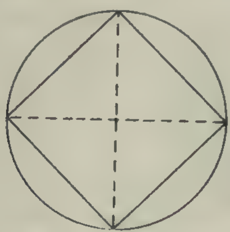
The boys in the first year now barely touch upon the subject of mechanical drawing but study the essential subjects leading up to it, thus laying a good foundation for future work. Useful geometrical constructions, elementary solid and descriptive geometry are taught. The instruction, being graphical, the same time gives the boys some practice in the use of instruments.

Second year boys will continue the study of geometry a little farther, and in addition will make free-hand sketches of models and from them make scale drawings.

The boys in the other years will advance further in that part of mechanical drawing essential to tradesmen. The making of free-hand sketches with the

views in proper relation to each other will be emphasized. Nearly all mechanical drawings as in the past will be made in pencil only, as more ground can be covered and they serve the purpose just as well. No drawings will be made by copying from blue prints, but a number of suitable exercises have been prepared, in which, for example, the plan and elevation of an object are given and the end view required.

To aid the teachers, and to make the instruction uniform over the whole system, an elaborate text book has been prepared and great pains have been taken in writing it to explain each step of each type of problem presented. It contains an abundance of drafting exercises, thus relieving the teachers from the difficult task of devising their own

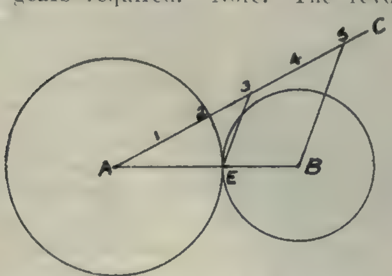


PROBLEM 23—PLANE GEOMETRY.

problems. The following extracts from the text book are typical of how the subjects are treated:

Problem 23, (Plane Geometry).—To inscribe a square within a circle.—Draw two diagonals at right angles to each other and join the points where the diagonals cut the circumference. (See sketch.)

Problem 24, (Plane Geometry).—Given the centres of two shafts, a certain distance apart, to connect them with two gears which will have one wheel making three revolutions while the other is making two.—Let A and B be centres of two shafts. From A draw the line AC at any angle, and upon it mark off five equal parts and number them. Join 5B and through No. 3 division draw a line parallel to 5B, cutting AB at E. AE and BE will be the radii of the pitch circles of gears required. Note.—The revolutions can be any number for each, but the principle if applied correctly will give the radii of both.



PROBLEM 24—PLANE GEOMETRY.

This problem will be fond useful in connection with gear wheels, and is based upon Problem 19.

Problem 1, (Projections).—Draw the plan and elevation of a 2 in. line at right angles to the V.P. and parallel to the H.P. and ½ in. away from both planes.—Use a folded piece of paper to represent the planes and place the wire representing the line in the position named and decide what to do. The drawing when completed would be as seen at Fig. 2, the outside rectangle ABCD representing the sheet of paper. XY is the ground line, therefore AXYB would be the vertical plane and XDCY the horizontal plane. The light lines are called the projector lines, and are necessary to ensure the placing of the views in line with each other but at right angles to the plane of projection.

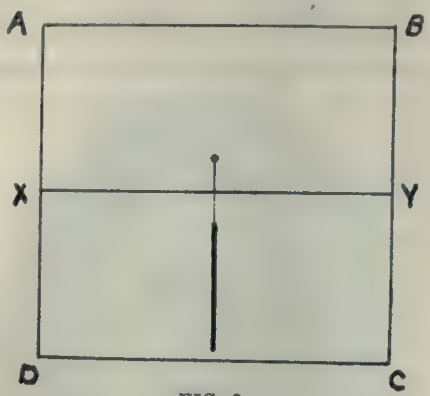


FIG. 2.

Problem 3, (Projections).—Draw the necessary views showing a trap-door, represented by a two-inch square when it is opened, so as to make an angle of 30 degrees with the floor, the hinged edge being at right angles to the V.P. Note.—The plan will show the square foreshortened lengthwise but still showing full depth.

Sections.

Hitherto these lessons have explained how objects are projected as seen directly in front (elevation), and from above (plan), and therefore the outside appearance and surface of solids only have been represented. Frequently this is insufficient to convey a clear meaning of the shape of an object and in addition to the elevation and plan there are often other views necessary to show the interior. This is done by means of what is called "sectional drawing," that is, a drawing of what is seen when the solid is cut leaving a level surface.

Mechanical Drawing.

All views in mechanical drawing, whether freehand or otherwise will be considered as having the object lying above the H.P. and in front of the V. P., and with their centre or main lines lying parallel to and at right angles to both planes.

To become efficient in sketching, practice drawing certain outlines with one stroke for a straight or circular line.

Freehand sketches will be made from each object showing all dimensions, and have each view placed in proper relation to each other.

When sketch is completed and passed as correct by the teacher the object will be put away and the mechanical drawing completed from the information contained in the freehand sketch.

No. 1—⅞ in. and 1 in. brake pin with 7-16 in. hole, to be drawn full size.

AN APPRENTICE SCHOOLHOUSE.

No. 2—Wrought iron link, to be drawn full size.

The examinations at the end of the session in this subject will be made on a fairer basis in future. It is likely first and second-year boys will have to solve a set of graphical problems which cover their work in the text book; while third, fourth and fifth-year apprentices will each be given a model and must make a sketch and workable drawing in a limited time.

Practical mechanics is taught one evening a week throughout the session. The aim kept in view in this subject is not to attempt work too advanced, but to train the average boy to apply

with the help of a text book a formula to the solution of any mathematical problem he is liable to run across in his every day work. The extent of the ground covered can be realized by studying the sample examination papers given below:—

First Year Apprentices' Examination.—Practical Mechanics.

1.—Find the sum of (a) 4.2700, 15.004, .9007 and 23; (b) ½, ⅜, 7-16, 9-32. (5)

2.—Subtract 7.462 from 9.005; 15 13-32 from 21. (5)

3.—Find the product of 623.4075 by 24.0259; ¾ x ½ x ¾ x ⅞. (6)

4.—Divide 357.84 by 25.6182; 17⅜ by 12½. (7)

5.—Extract the square root of 119025; 5.322249.

6.—Find the surface of a cylinder 23 in. diameter by 39 in. long. (9)

7.—Find the number of U.S. gallons of water, and the weight of the water in a semi-spherical vessel whose diameter is 36 in. (10)

8.—Find the area of a triangle whose base is 56 in. and height 78 in. (9)

9.—The diameters of two circles are 14 in. and 8 in. What is the difference in their circumferences? (9)

10.—Find the weight of a rectangular steel billet 4 ft. long, 14 in. wide, and 8 in. thick. (10)

11.—A locomotive boiler contains 217 tubes, 2 in. O.D., 11 ft. 6 in. long. Find the total heating surface (outside surface) of the tubes. (9)

12.—A cast iron ball and a steel ball each have a diameter of 8 in. Find the difference in weight of the balls. (12)

All questions can be attempted.

The value of each question is shown thus:—(9).

Put the number of your question before your work.

Sufficient details of your calculations must be given in order to show the methods employed in obtaining the results.

Write only on one side of your paper.

— Time 2 hours.

Second Year Apprentices' Examination. Practical Mechanics.

1.—Multiply 3.00704 by 4.0205; ¾ by 5 1-9 by 7 1-5. (5)

2.—Reduce ⅜, 7-16, 5-32 and 11-64 to decimal fractions. (5)

3.—Extract the square root of 22,071,-204; 42.03. (8)

4.—(a) How many square yards, square feet and square inches are there in 156.738 square inches?

(b) Find the number of cubic inches in 12 cu. yds., 23 cu. ft. (9)

5.—A locomotive boiler contains 225 tubes 2 in. O.D., 165 in. thick. Find the total area in square inches of the openings for the passage of the gases. (8)

6.—A lever 66 in. long has a weight of 48 lbs. on one end. The fulcrum is placed 8½ in. from the weight. What power must be supplied at the other end of the lever to balance it? (8)

7.—With an available power of 240 lbs., what weight can be lifted by a 3 cord pulley? (7)

8.—A train moves uniformly at a speed of 45 miles per hour. How long will it take it to go 1,200 ft.? (8)

9.—A shaft has a pulley 23 in. diameter keyed to it and revolves at the rate of 92 revolutions per minute. This drives another pulley 18 in. diameter. How many revolutions per minute will the latter pulley make? (9)

10.—A rectangular block is 4 ft. 3 in. long, 2 ft. 6 in. wide, and 3 ft. deep. Find (a) its surface, (b) its cubic contents. (11)

11.—The front cylinder head of a cylinder 23 in. diameter is held by 24 studs. If the pressure in the cylinder is 160 lbs. per square inch, what is the stress on each stud? (12)

12.—A locomotive tender tank is to have a capacity of 7,000 U.S. gallons of water. It is to be 24 ft. long and 10 ft. wide inside. Find the depth. (10)

All questions can be attempted.

The value of each question is shown thus:—(9).

Put the number of your question before your work.

Third Year Apprentices' Examination.—Practical Mechanics.

1.—The area of a triangle is 216 sq. inches and its perpendicular height is 24 inches. Find the base. (5)

2.—Extract the square root of .000133225; $\frac{15129}{182329}$. (6)

3.—The driving wheels of a locomotive are 73 in. diameter and the truck wheels 36 in. diameter. How many more revolutions will the truck wheels make in going 5 miles? (9)

4.—The outside dimensions of a rectangular box with covers made of oak 1 in. thick, are 7 ft. long, 8 ft. wide, and 9ft. deep. Find the capacity of the box and the number of square feet of lumber in it. (10)

5.—What force is necessary to raise a body weighing 120 lbs. with a six cord pulley? (6)

6.—How long would it take a train to go 240 miles with a velocity of 22 feet per second? (8)

7.—A lever 42 in. long has a weight 56 lbs. suspended from one end. What force must be applied at the other end to lift the weight if the fulcrum is 8 in. from the weight? (7)

8.—An iron casting measures 7 ft. 5 in. long by 3 ft. 10 in. wide by 7 in. thick. In this casting are cut two slots each running the whole length of the casting, one being 1 ft. wide by 1 in. deep, the other 8 in. wide by 1½ in. deep. What is the weight of the casting before and after the slots are cut? (9)

9.—A reservoir 150 ft. long by 65 ft. wide contains 13,500 gallons. Find the depth and weight of the water. (9)

10.—A train weighs 975 tons and the resistance is 10 lbs. per ton. Find the work done in drawing it 1½ miles at uniform speed. (9)

11.—The counterbalance on the driving wheel of a locomotive weighs 640 lbs. and the centre of gravity is 24 in. from the centre of the axle. What is the centrifugal force of the counterbalance when moving through 35 feet per second? (12)

12.—A hollow cylindrical cast iron column is 50 ft. high, outer diameter 5 ft. and inner diameter 3 ft. Find the weight of the column and cost of painting the outside surface at five cents per square foot. (10)

Fourth Year Apprentices' Examination. Practical Mechanics.

1.—The driving wheel of a locomotive is 72 in. in diameter and it makes 250 revolutions per minute. Find the speed of the locomotive in miles per hour. (6)

2.—The circumference of a circle and the sum of the sides of a square are the same, 7,744 inches. Find the area of each. (8)

3.—The area of a square is 162 sq. ft., 36½ sq. in. Find the length of the sides. (7)

4.—The distance from the fulcrum to the end of a lever, at which a force of 145 lbs. is applied, is 5 ft., and the distance from the fulcrum to the weight is 1½ in. How great a weight will the force lift? (8)

5.—A block of steel is triangular in shape with a base of 5 ft. 6 in., and height 4 ft. 3 in., and the block is 6 ft. 6 in. long. What is the weight of the block? (9)

6.—Two bodies A and B start from the same point and move in opposite directions. A moves at the rate of 15 ft. per second and B at the rate of 15 miles per hour. (a) What will be the distance between them at the end of 10 minutes? (b) How long before they will be a quarter of a mile apart? (10)

7.—A chain weighing 10 lbs. per foot of its length is 125 ft. long and hangs vertically; what work is done in winding up the chain on a drum? On raising the lower end to meet the upper. (8)

8.—A cast iron sphere 4 in. in diameter is revolved in a circle in which the centre of the sphere to the centre of the circle is 15 in. If the sphere makes 60 revolutions per minute, what is the tension of the string? (10)

9.—With a system of 7 pulleys, what

force must be applied to the free end of the rope to raise a weight of 2 tons? (6)

10.—A pulley 14 in. in diameter makes 140 revolutions per minute. Another pulley connected by a belt makes 45 revolutions per minute. Find its diameter. (7)

11.—(a) What do you understand by "Kinetic Energy?"

(b) A solid cast iron ball 8 in. in diameter has a velocity of 45 feet per second. What is its kinetic energy? (9)

12.—The cylinders of a steam engine are 18 in. diameter by 24 in. stroke, and the mean effective pressure is 153 lbs. per square inch. Find the horse power if 275 strokes are made per minute. (12)

Fifth Year Apprentices' Examination.—Practical Mechanics.

1.—Find the outside surface, volume, and weight of a cast iron cylinder 23 in. O.D., 20 in. I.D., and 40 in. long. (7)

2.—A piece of metal 3 in. in diameter is being turned in a lathe, the spindle of which makes 25 revolutions per minute. Find the speed of cutting the metal. If it is desired to turn a 2 in. piece of metal at the same cutting speed, how many revolutions must the spindle make per minute? (10)

3.—What is the tractive power of a locomotive with cylinders 22½ in. diameter by 30 in. stroke, driving wheels 63 in. diameter, and boiler pressure 180 lbs. per square inch? (7)

4.—The diameter of a small ram of a hydraulic press is 2 in., and the diameter of the large ram is 7 in. The lever arm is 24 in. long, and the distance from the fulcrum to the small ram is 4 in. What power is necessary at the end of the lever to raise a weight of one ton? (8)

5.—(a) What do you understand by "Centre of Gravity?"

(b) Two bodies weigh 12 and 35 lbs. respectively and the distances between their centres of gravity is 38 in. Where is the centre of gravity of both bodies located? (7)

6.—A hammer head weighing 50 lbs. strikes with a velocity of 40 ft. per second and 25 blows per minute. What is the kinetic energy possessed by the hammer head per blow, and at what horse power does it work? (7)

7.—In a steam engine the indicated horse power is 540, but it is known that 6 horse power is lost in overcoming friction, etc., in the engine. What percentage of the horse power is used for useful work? (8)

8.—A loaded truck weighing 12 tons is pulled along a level track. If the resistances to motion are 11 lbs. per ton, find the work done in pulling the truck a distance of one mile. What is the horse power exerted. (8)

9.—(a) What is the hauling capacity of a locomotive having a weight of 179,000 lbs. on the driving wheels, the total weight of the engine and tender loaded being 340,000 lbs.?

(b) What is the adhesive weight of the locomotive? (8)

10.—(a) What do you understand by "Centrifugal Force?"

(b) A locomotive weighing 110 tons runs around a curve of 955 feet radius at a speed of 30 miles per hour. Find the centrifugal force. (8)

11.—(a) A weight of one ton is suspended by a sling chain. The length of each side of the chain is 18 feet and the height at the centre is 13 feet. What is the stress on each leg of the chain?

(b) What will be the stress on each leg if each side of the chain is 18 feet and the height decreased to 7 feet? (10)

12.—A train 300 feet long, travelling at the rate of 60 miles per hour, passes another train, 350 feet long, travelling at the rate of 40 miles per hour. How long do they take to clear each other (a) when travelling in the same direction, (b) when travelling in opposite directions? (12)

All questions can be attempted.

The value of each question is shown thus:—(9).

Put the number of your question before your work.

Sufficient details of your calculations must be given in order to show the methods employed in obtaining the results.

Write only on one side of your paper.

For this course text books are used also, there being one for each year. Every apprentice has the use of one of these during the session and in fact any employe of the company may borrow one for review purposes at any time. They contain all the formulae dealt with in class and show how to use them. They also contain an abundance of practical problems to be solved in class. The following are typical quotations from these books:—

Simple Multiplication.

Multiplication is a short method of addition. Thus, if nine were to be multiplied by five, the answer would be $9 + 9 + 9 + 9 + 9 = 45$. This method would not be convenient, and with the use of the multiplication table the question would simply be a mental one, thus $9 \times 5 = 45$.

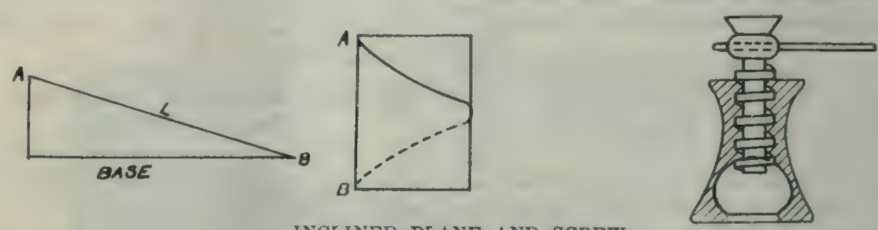
The Sphere.

A sphere is a solid object having a curved surface, all points on which are an equal distance from a point within called the centre. The area of its surface is found by multiplying the square of the diameter by 3.1416 and this rule stated as a formula would be $A = D \times D \times 3.1416$.

Example.—A hole is punched through a ½ in. plate, the pressure being 36 tons. Find amount of work done. $W = F \times S$; $F = 36 \times 2000$; $S = \frac{1}{2}$ of 1-12; therefore, $W = 36 \times 2000 \times \frac{1}{2} \times$ 1-12 $= 3000$ ft. lbs.

The Screw.

The screw is the last of the mechanical powers and if carefully observed it will be seen to be the same in principle as the inclined plane. A thread is cut around a cylindrical piece of metal; the distance between centre of threads being known as the pitch. Cut out in paper an inclined plane having as its base a length equal to the circumference of the cylinder around which it is proposed to cut a thread and having a height equal to the pitch of the threads. Place this around the cylinder and the screw thread will correspond to the side L on the inclined plane, or the hypotenuse of a right-angled triangle.



INCLINED PLANE AND SCREW.

As in the case of the course in mechanical drawing, an examination is given at the end of the session on the course in practical mechanics. These examinations are set and conducted by the supervisor of apprentices, and the drawings and papers are marked by neutral examiners. This creates rivalry between the different stations to obtain the highest class average and encourages competition among the boys themselves. The marks made by each apprentice serve as a record of his efficiency, and the class averages are valuable to the superintendent of motive power and other officials connected with the apprenticeship system in comparing the efficiency of instruction at the various shops.

To increase the competition in these examinations various encouragements are given. Five hundred and ninety dollars are given as prizes each year, of which twenty-eight dollars are available to the best student. Diplomas of honor are awarded to each boy heading his local class, also to each class having the highest average, and to the shops ob-

taining the highest standing in each subject. Should one shop head the list in both subjects the apprentices at that station are given a free excursion to their choice of several destinations. As may be imagined, the competition in the past has been very keen, thus encouraging both teachers and pupils to take a greater interest in their work.

Records of Apprentices.

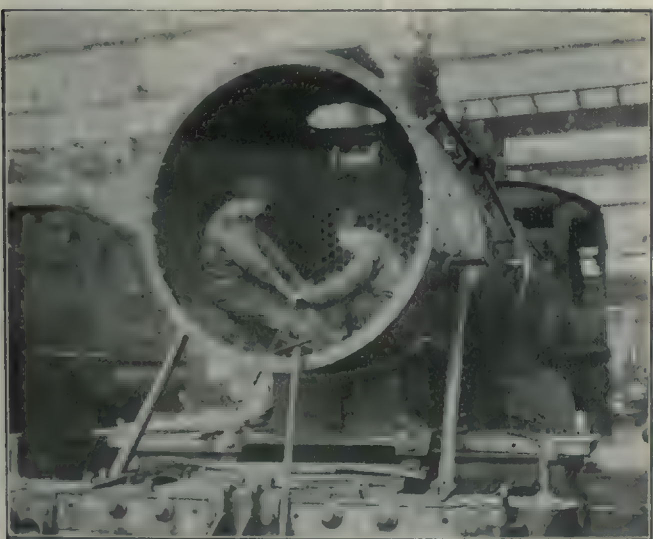
To make the system of greatest value to any management, suitable records should be kept of the apprentices since they are to be the future mechanics and officials. This is especially true where there are so many apprentices as in a large railroad corporation.

The G. T. R. keeps a record of each boy's work and conduct in the shop and class room. The supervisor of apprentices records each boy's marks at the yearly examinations in drawing and practical mechanics, and points out from time to time to the superintendent of motive power and the master mechanics any boy who is doing exceptionally well in the school work. It is advisable to keep this record because few boys make skilled mechanics who are not bright at drawing and mathematics.

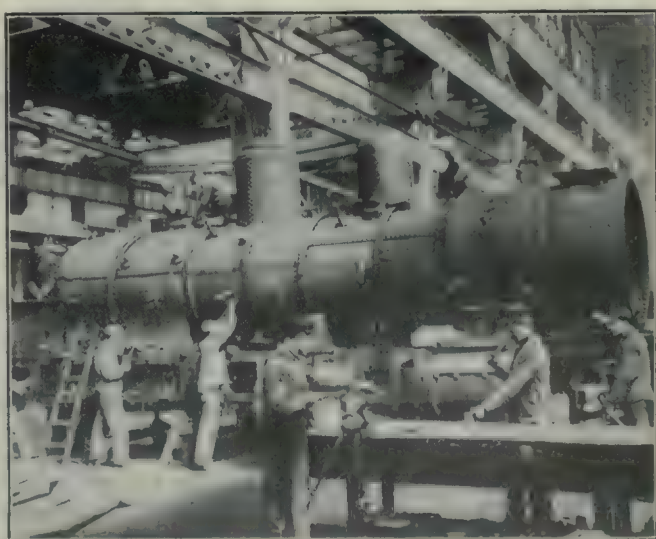
APPRENTICES AT WORK IN THE AIR-BRAKE DEPARTMENT.

APPRENTICES WORKING IN BOLT DEPARTMENT.

The apprentice instructor keeps a record of the apprentice's work in the shop showing the various gangs and departments worked in and the length of time in each; the boy's conduct and attendance when in those departments, and the results of examinations in shop practice. The boy's letter of application contains the information regarding his previous education. These records are valuable to the management in selecting young men for particular positions.



APPRENTICES FITTING THE FRONT END.



THE APPRENTICE REBUILD GANG.

Social Side of System.

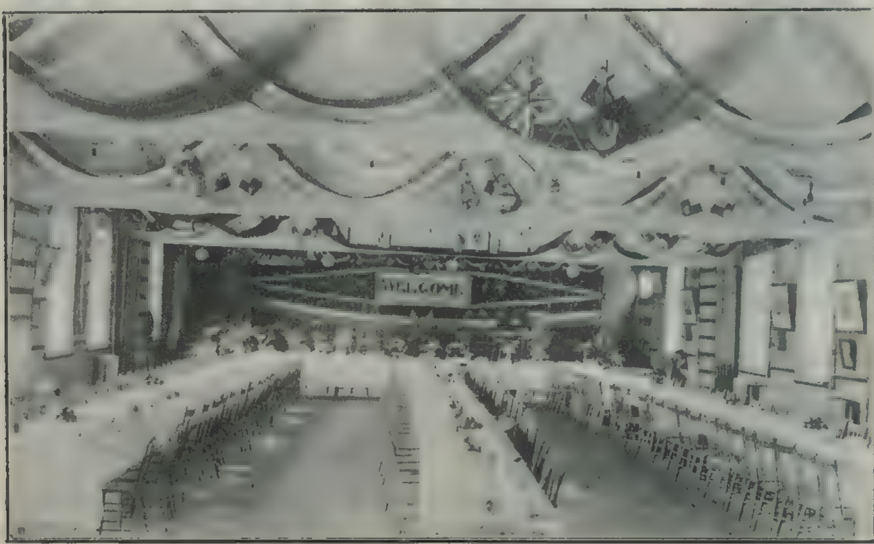
The social problem is an important one for the management to handle. Social activity has two effects: it keeps the majority of the apprentices happy and contented with their chosen professions and it attracts other boys into the service. Get Harry Smith talking about the man-sized work he is doing, about the success of the Grand Trunk baseball and football teams, about the apprentices' banquets, excursions, etc., and about the dances he gets into in the winter, and you will not only keep Harry contented but also attract his friend Bill to become an apprentice, who perhaps had always looked upon the dark side of this profession—thinking only of the long working hours and dirty work. Hence it is to the company's advantage to foster social activity.

Social life among the apprentices of the Grand Trunk has reached a very desirable status. The employees have a first-class band at a number of stations, also hockey, baseball, football and cricket clubs in which a large number of apprentices take an active part.

At the larger shops, the apprentices

have an annual banquet which is run entirely by themselves, each paying a small amount to help defray expenses. Friends and representatives from other shops are invited. A musical programme is provided and speeches are made by a number of boys selected from each class, also by graduate apprentices and prominent men interested in industrial education. Besides being a social function, this feature is also a source of education.

The apprentices have a fund which they maintain for such expenses as the purchase of models for the class-room or flowers for a fellow apprentice who may be sick or has been bereaved. Prize money won by the class as a whole or by showing drawings at exhibitions is usually voted towards this fund.



APPRENTICE CLASS ROOMS TURNED INTO A BANQUET HALL.

Pass privileges are extended to all apprentices, but more generously to those living away from home, it being the company's desire to keep the boys in close touch with their parents. The free excursion, in a coach by themselves, given the apprentices of the shop leading in the school work, is an outing greatly coveted by the boys.

It is also the company's desire to make the boys present a neat appearance both on the street and in the shop, and to feel proud of the fact that they are G. T. R. apprentices. Many a boy, on a Monday morning, has been sent home for a clean pair of overalls, and no apprentice need go home with dirty hands and face with the excuse that there are no wash-basins, no towel lockers, and no hot water in the shops.

If all similar and kindred concerns were as successful in looking after the social life of their employees, and were as strict and painstaking in keeping their shops clean and sanitary, there would be less heard of "boilermakers and greasy mechanics."

Results From the System.

This scheme of making their own mechanics has been a paying enterprise for the G. T. R. from the very start. In the year 1901, the company spent $275 on the apprentices in the motive power department, while in 1913 it quite willingly expended nearly $8,000, although during the elapsed period the number of employees in the department increased only from about 5,500 to 10,000. It is money well invested, for the company's greatest asset lies in its apprentices and young men, as by the proper training of their workmen, they eliminate to a large extent the waste due to abuse of machinery and tools, as well as a low standard of, and spoiled, work. To-day, approximately 100 apprentices graduate each year, of which number about 90 per cent. remain in service for at least one year, and a high percentage stay much longer. Every inducement is offered to keep graduates in service. The apprenticeship system is solving the problem of providing a supply of competent workmen and supervisors—a matter of great importance to the company.

The boys also derive many benefits from the system. During apprenticeship, the boy is paid wages sufficient to board and clothe himself, and has to pay out nothing to enter the service, nor for tuition fees and books. He enjoys an active social life among those of his own age and with similar ideals in life. His instruction in the school and shop is guided by competent men along lines directly connected with his future occupation. Eeach graduate is given a bonus of twenty-five dollars and a certificate of apprenticeship. Again, a graduate apprentice is given first chance whenever there is an opening for a chargeman, foreman or master mechanic.

In the future even greater results will be obtained as the outcome of experience and research in preparing apprentices for their future work. At the present time a new plan is being tried out in which the students are taught by correspondence supplemented by periodic visits from travelling instructors. This is being used for those classes where there are not sufficient number of apprentices to have a special instructor or where there is no competent instructor available. This should be very successful in giving every apprentice an equal opportunity to make good, no matter whether he be in a large repair shop or in a small roundhouse.

B. C. MANUFACTURERS' ASSOCIATION.

BUREAUS are to be established in London at once and in Paris and Petrograd later in connection with the activities of the B. C. Manufacturers' Association to secure a share of the business resultant on the war. The organization now has a representative in Ottawa who is keeping constantly in touch with the militia department and advising provincial manufacturers of goods required for the Canadian troops as well as of intending purchases by the Allies. H. M. Daly, a son of the late Hon. T. Mayne Daly, is acting as the association's representative at Ottawa.

A. E. Howard of Vancouver has been appointed to represent the B.C. Manufacturers' interests in London, and he will leave at an early date to assume his duties. Full lines of samples of British Columbia products will be taken over by the agent and an effort will be made to submit bids on the goods required that the province is able to supply. Particular attention will be paid to the lumber business.

After the London office has been organized Mr. Howard will make arrangements for representation of the B. C. Manufacturers at Paris and Petrograd. The prospects for the development of trade betwen British Columbia and Russia are very good in the estimation of local manufacturers. Shipments can be sent from Vancouver to Vladivostock and thence across Siberia by the Government Railway.

A Sufficient Lifter.—A long-handled small magnet has proven a great machine-shop convenience, for picking up small nuts and other articles of iron or steel in places difficult to reach. Little objects not of iron or steel are misplaced also, and now it is proposed to secure these by a variation of the vacuum cleaner, a rubber suction cup at the end of a hollow handle being connected to the pipe of an exhaust pump, with a small thumb-valve for control.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A UNIQUE SUB-PRESS DIE CONSTRUCTION.

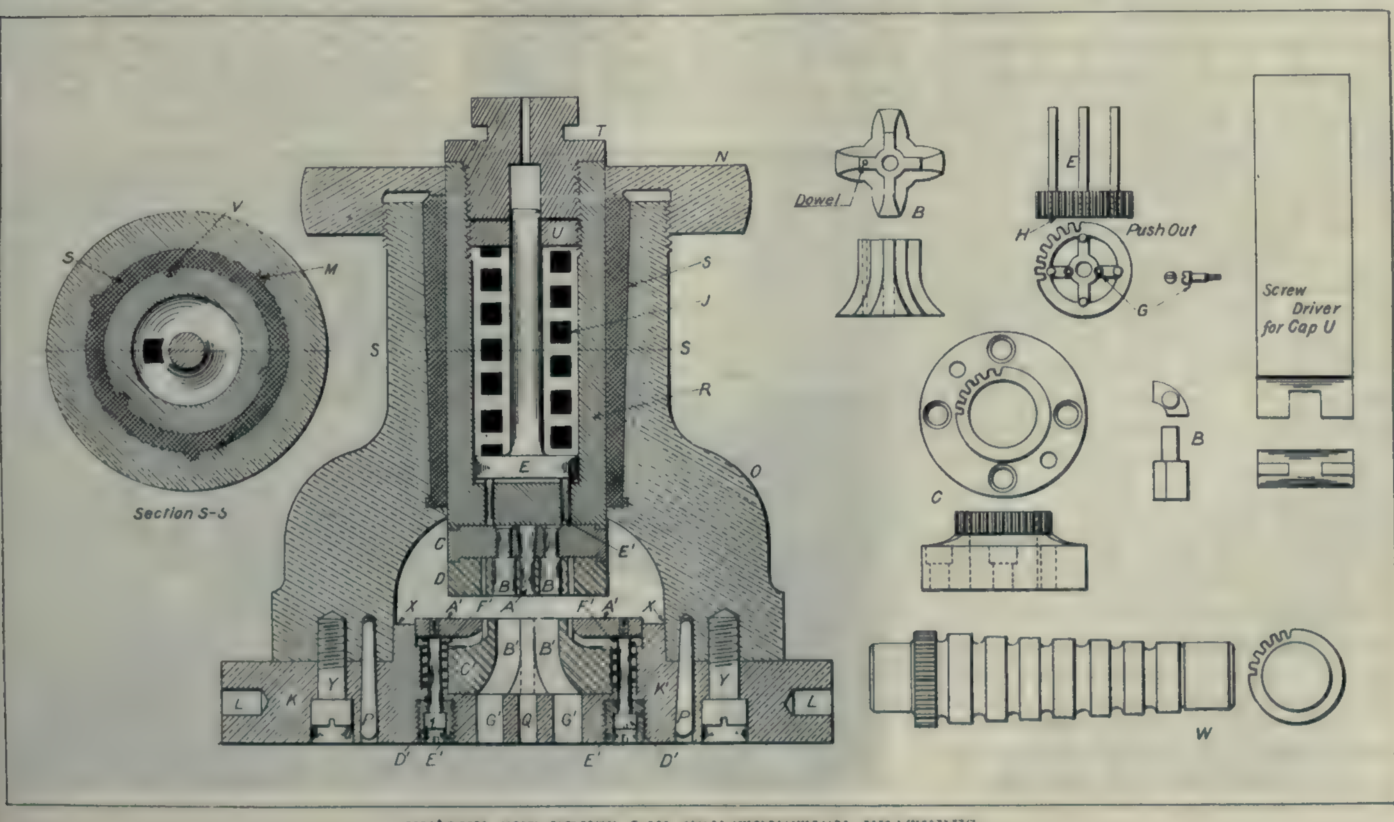
By A. L. Monrad.

FOR close, accurate, clear-edged punching a sub-press die is a most economical and satisfactory tool. The writer has selected, for illustration, a four-armed brass gear wheel. Although an innocent-looking piece, it required considerable accuracy. The gear wheels are blanked from a single strip, 0.032-inch thick; are returned again into the strip by the shedder and are carried along out of the press as the strip is fed through. Care should be taken to select a proper size or number sub-press and, as the diameter of the gear wheel is 1.189 inch, a No. 3 press is most suitable.

Having selected a sub-press with its proper cap, the frame O is held in the chuck on a lathe, and the bottom faced off, while the recess XX is bored, 1 degree tapered, and made a snug fit to correspond with the step on the base K on the lower part of the sub-press. This is also held in a chuck and the bottom faced off. Two ⅜-inch holes LL are drilled, one on each side of the base, to receive finger straps to secure it firmly on a face-plate when facing, turning and boring the top side. The centre is bored out a push fit to receive the stripper plate A', blanking punch B', and a ¼-inch hole Q drilled, bored and reamed completely through it to allow scrap punchings to fall to the floor.

Two ⅜-inch holes Y are next located, drilled and counter-bored in the base K, these holes being then transferred into the frame O and tap drilled in about ½-inch. When base and frame are assembled, holes are drilled and reamed for the dowel pins PP. The sub-press die is now ready to be placed together and strapped on to a face-plate. A plug centre is turned while in the spindle of the lathe to fit the ¼-inch hole A in the base. On this plug the sub-press is clamped centrally on the face-plate, care being taken that the face runs absolutely true. In this position the frame is bored out to a taper of about half-inch per foot, and the bottom hole is bored parallel to fit the plunger R. With the same taper setting of the lathe, while it is locked by means of the back gears, three circular grooves M are splined the entire length of the bore, as shown in sections SS, by moving the lathe carriage back and forth. The spacing of these grooves is immaterial, as they act only as a key for the babbitt S. The end of the frame is now turned and threaded to receive the cap N, and this is screwed on securely and the hole in the cap bored straight to a snug fit for the plunger R. This is done in order to line the holes perfectly central with the die construction details, bore, frame and base.

The plunger R is made of low-grade tool steel. It is first rough turned on the outside, then placed in a centre rest and a deep hole is bored to a free fit for piston F. The end of this hole is threaded to a tight fit for button T. Threading should be carried one inch deeper than the thread of the button in order to allow for the tension cap U. By adjusting this cap, sufficient tension can be placed on the stripper spring J to force the blank back into the stock again after being punched out. This, of course, takes place on the return or upward stroke of the press. The button T is made of a low-grade tool steel, an eight-inch hole being drilled through its centre to let the air out from the inside during operations. Centre ream both ends and turn the head to a free fit in the T-slot of the press. The other end is threaded to a forced fit and square shoulder in plunger R. The bottom end of button T is counter-bored to a free fit for piston F. With the button in the plunger and a lathe dog on the T-end of button, the plunger is ground (not turned) perfectly parallel to a snug fit for the hole in the cap N. Three irregular 3-16-inch radii,



UNIQUE SUB-PRESS DIE CONSTRUCTION FEATURES.

about 1-16-inch deep grooves V, are cut the entire length of the plunger. These will match convex projections of the babbitt S and prevent a careless operator from entering it the wrong way. It is very essential that these grooves be milled absolutely parallel with the axis of the bore of the plunger. Therefore, try it on a turned bar with a sharp V cutter. It can easily be detected with the aid of a magnifying glass if its cuts parallel both sideways and for depth.

A machinery steel ring is turned and bored to a force fit on the end of the plunger R and about one inch wide. Adjust the centre rest to this ring with the plunger in proper place, using the plunger as an arbor. This is done in order to prevent the ground surface of the plunger being marked or injured from the jaws of the steady rest. Now bore out the recess on the end of the plunger R to a snug fit in the punch holder C. The ejector spring J is made from a good grade tool steel and spring tempered to a very dark blue. It can either be turned or rolled from a 5-16-inch square stock, leaving plenty of room to float around between the piston F and plunger R. The piston F is made of tool steel, and the disc end only is hardened to a dark straw color. It is turned to a free fit in the plunger bottom and tension cap U, the disc end being faced off by grinding.

The punch holder C is made of low-grade tool steel and not hardened. It has a recess on each side about 1-16-inch deep to a good fit on the end of plunger R and the die D. The holder is screwed and dowelled to the plunger not shown in the assembly drawing. The shanks on punches B should be riveted on top into holder C, after being fitted and located properly and hardened to a light straw color. The shank on the centre punch A is tapered as shown. This is done so it will not pull out, and is also hardened to a straw color.

The die D is made of the best grade die steel held up with four screws and dowelled into the holder C; great care should be taken to have the gear teeth broached central with the die. This was done by making seven broaches, as shown at W. The steps should be so spaced that before one stops cutting the other should take hold. In the last two or three steps it must not cut any more than .0005-inch at a chip for the finishing broach, but in the roughers the cut should be about .001 inch. They should be backed off very slightly on top and finished with a good sharp gear cutter, having the milling machine centres dead parallel. A very thin slot, about 0.020 inch, should be cut through the side of the screw holes from the outside diameter in order to prevent cracking the die in the hradening and draw the temper to a light straw color.

The push-out E is made of tool steel and spring tempered. This goes up in the die and fills the spaces between die D and punches A and B, the stems E going up against piston F and kept from dropping out by the two ⅛-inch shoulder screws G. These are screwed into the holder C against the shoulder, and the heads counter-bored into push-out gear plate H. The counter-bored holes should

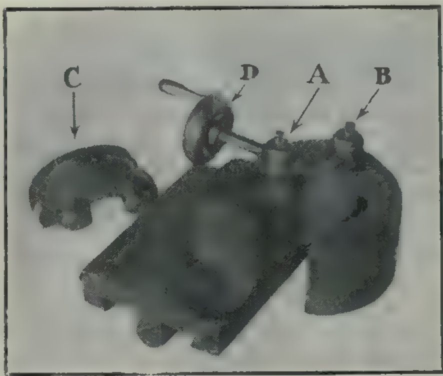


FIG. 12. ANOTHER HANDWHEEL TURNER.

be 1-16-inch deeper than the whole length of the screw and the push-out about ⅛ inch thinner than the die. The punches BB do not have to fit the push-out as close as they do the die, but have a rather easy sliding fit. When the brass gear is punched is shoves H upwards, forcing piston F against spring J, as shown, until the plunger R starts back. The spring J forces push-out H down again, thus pushing the blank out of the die and back into stock from where it has just been punched. Now when the tension is on spring J, the piston F will rest on bottom of the hole in the plunger R. In this position the pins E should be trimmed off until push-out H is flush on the face with die D. The screws G should now shoulder on C and H at the same time. This final assembling is generally done after all parts are hardened, ground and lapped, but in this particular case very few parts are so constructed to permit it to be ground unless a master plate is made, which means a considerable expense, unless duplicates of the same die or parts are wanted.

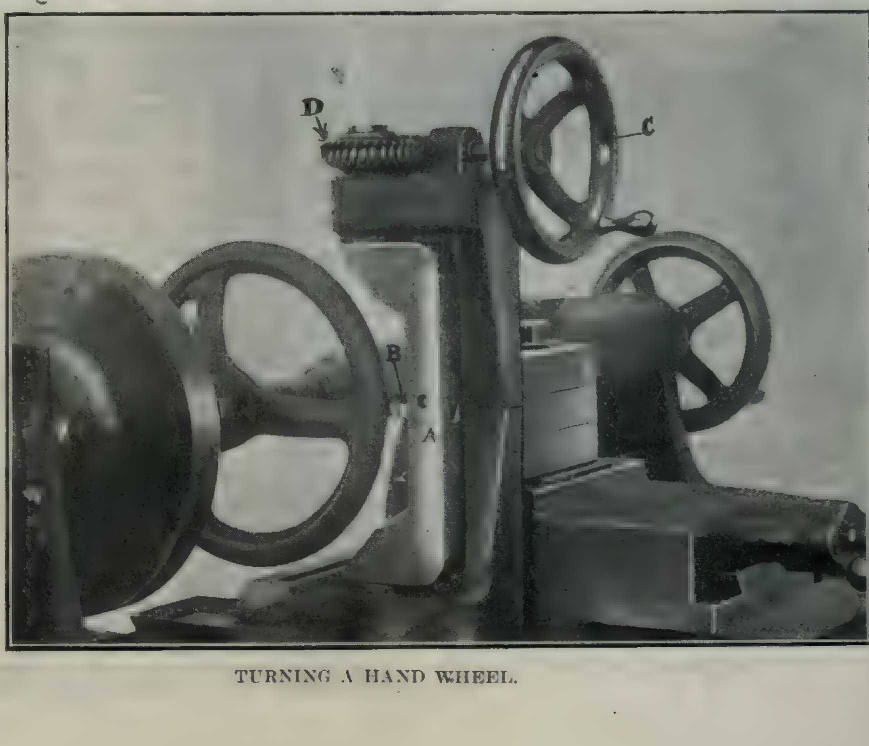
The punch construction will be featured in our next issue.

DEVICES FOR FINISHING SPHERICAL SURFACES.

By Avery E. Granville.

THE finishing of handwheel rims is often a problem and in Fig. 11 is shown one solution. The handwheel is mounted on a mandrel and placed between the lathe centers. A cutting tool B is carried in a swinging yoke A mounted in a bracket bolted to the tool slide. The yoke is given a rotary motion by means of the worm gear D and a worm operated by the handwheel C.

Another handwheel turning device intended to be placed on a lathe cross-slide is shown in Fig. 12. Two cutting tools are carried in the tool posts A and B, so that it is only necessary to make a quarter turn to surface off a rim. The toolposts are mounted in a segment exactly like the one shown at C. A worm operated by the handle D gives the rotary movement to the worm gear segment. The reason that the segment C is shown is that the two segments were originally made in one piece and then cut in half. It was easier to machine in this way and, in case anything happens to the segment in use, another is ready to put in its place.



TURNING A HAND WHEEL.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

KEYS AND KEYWAYS.

LIKE a number of other very much-used parts of machinery, we have no standards for key and keyways, each large or small plant adopting rules of its own. A common practice is for the draughtsman to make up a sheet upon which the dimensions of keyways for all sizes of shafting in use are given in order, and the sheet is hung up convenient to the milling machine or key-seater operator. These sizes, obtained by the formula adopted by the draughtsman, become the standards of the plant.

Designers usually adopt some empirical rule for the dimensions of keys, numbers of which can be found in most any engineers' hand-book. The keys ordinarily met with in the shop may be divided into two classes, the taper sunk key and the feather key, and simple rules governing these are about all the average mechanic has occasion to remember. By these rules the size of the keyway is made proportional to the size of the shaft regardless to the load carried by it, so that the designer must look out for light or excessive loads by making the hubs shorter or longer.

In plants where a large amount of mill work and such like is done, it is found convenient to make up keys in large batches to standard dimensions. Likewise, the hubs of pulleys are made to standard lengths to correspond. Thus ⅝-in. keys and hubs would be limited to 3, 4, 5 and 6-inch lengths, and the man cutting the key-seat in the hub delivers his work with a suitable key.

The ordinary sunk taper key is most used, as it provides resistance, not only against torsional stress, but axial motion as well. It should be well fitted both side-ways and top and bottom. All dimensions should refer to the large end of the key. A very serviceable and much-used rule for the dimensions of these keyways is as follows: The width of the keyway is made ¼ of the shaft diameter. The depth of the keyway in the shaft is made equal to ¼ of its width and the depth in the pulley is made equal to ½ of its width. This means that the key thickness is equal to ¾ of its width and its width is ¼ of the shaft diameter. One advantage of thus dimensioning the keys is that stock can be bought of approximately the correct sizes. Thus 1-in. x ¾-in. steel will make 1-in. keys with the minimum of waste.

Another rule very similar to this makes the thickness equal to 1-6 the shaft diameter. This may possibly give a slightly better value but to divide 16ths by 6 is slightly inconvenient for many mechanics. Other such rules are width = ¼ diameter + ⅛ in. Thickness, ⅛ diameter + ⅛ inch. Also, width = 3-16 diameter + 1-16 inch; thickness = ⅛ diameter + ⅛ inch.

* * *

Question.—According to the first rule, what should be the dimensions of the keyways in a 3 7-16 shaft and a coupling to fasten to it?

Answer.—Width of keyway $= \frac{3\ 7\text{-}16}{4} = \frac{55}{16\times4} = \frac{55}{64} =$ to nearest 16th, ⅞-inch key.

Depth of keyway in shaft $= \frac{7}{8\times4} = \frac{7}{32}$ inch.

Depth of keyway in coupling $= \frac{7}{8\times2} =$ 7-16 inch.

Thickness of key at large end is 7-32 + 7-16 = 21-32 inch.

* * *

Question.—What would be the dimensions of a key for a 3-7-16 shaft, according to the second rule?

Answer.—Width of key = 3 7-16 ÷ 4 $= \frac{55}{64} =$ to nearest 16th, ⅞ inch.

Thichkness of key = 3 7-16 ÷ 6 $= \frac{55}{96} =$, to nearest thirty-second, 19-32 in.

* * *

It will be noted that the most variable dimension is the thickness. In the case of a feather key which has no bearing on top, the key is usually made square. As the crushing resistance is approximately twice the shearing resistance of the metal, this would seem to be the proper form of key. With a sunk key fitted top and bottom, however, a wedging action causes the crushing surface to be extended from the sides over the top and bottom so that the thickness is really not so important a dimension as the width, which determines the shearing strength.

* * *

Question.—The coupling of a 2-15-16 shaft has to transmit its full strength. What should be the dimensions of a key for this purpose?

Answer.—The torsional strength of a shaft is represented by the formula $\frac{d^3 S\ 3.1416}{16} = T$ where d = diameter of shaft and S = shearing strength of the material. For a 2-15-16 shaft this becomes:

$$\frac{(2\ 15\text{-}16)^3 \times 50{,}000 \times 3.1416}{16}$$

This acts upon the key at a distance from the centre of the shaft equal to the radius; or, the force becomes

$$\frac{(2\ 15\text{-}16)^3 \times 50{,}000 \times 3.1416}{16 \times 1\ 15\text{-}32}$$

= 169.406 pounds tending to shear the key.

The shearing resistance per inch of a ¾-inch key is 50,000 × 1 × ¾ = 37,500 pounds. The length of the key and hub is $\frac{169406}{37500} = 4.5$ inches.

* * *

Question.—What should be the dimensions of a key to transmit the full strength of a 1 7-16 cold rolled steel shaft?

Answer.—The width of the key would be 1 7-16 ÷ 4 = ⅜ inch to nearest sixteenth.

A very good formula for the length of key where key and shaft are of the same material is, $L = \frac{d^2 \times 3.1416}{8 \times W}$ where d = shaft diameter and W = key width.

For the above, this becomes

$$\frac{1\ 7\text{-}32 \times 1\ 7\text{-}32 \times 3.1416}{⅜ \times 8} = 1.55 \text{ inches.}$$

The hub would actually be made somewhat longer than this.

* * *

Question.—What would be the dimensions of a cold rolled steel key for a 4½-inch cast iron shaft?

Answer. — The general formula for keys and shafts of different materials is, $L = \frac{d^2 \times 3.1416 \times Ss}{8 \times W \times S's}$, where L = length of key, d = diameter of shaft, Ss = shearing strength of shaft material, W = width of key and S's = shearing

strength of key material. Substituting values, this becomes

$$\text{Length} = \frac{20.25 \times 3.1416 \times 18000}{8 \times 1.125 \times 50000} = 2.57 \text{ in.}$$

* * *

Question.—A lever with a suitable hub at one end is fastened to a 2-inch steel pipe with a taper pin. What should be the mean diameter of the pin to take the full strength of the pipe, assuming that drilling the hole reduces its strength by 10 per cent.?

Answer.—Outer diameter of 2-inch pipe = 2.375 inches. Inside diameter = 2.067 inches. Torsional strength of a hollow shaft is

$$T = \frac{(D^4 - d^4)}{D} \times \frac{3.1416 \times Ss}{16}$$

at the circumference of the pipe or shearing point of the pin this force becomes

$$\left(\frac{D^4 - d^4}{D}\right) \times \frac{3.1416 \times Ss}{16} \times \frac{2}{D}$$

in which D = large diameter, d = small diameter and Ss = shearing strength of pipe material. Substituting values, we have

$$\frac{13.562}{2.375} \times \frac{3.1416 \times 50000}{16} \times \frac{2}{2.375} = 47.212$$

pounds. 47,212, less 10 per cent. = 47,212—4,721 = 42,491 pounds. Shearing area required $= \frac{42{,}491}{50{,}000} = .8498$ sq. in. Pin is in double shear. Cross sectional area required $= \frac{.8498}{2} = .4249$ square inch.

Mean diameter of pin is, therefore,

$$\sqrt{\frac{.4249}{.7854}} = \sqrt{.5409} \doteq .735, \text{ or very nearly}$$

¾ of an inch.

HIGH-GRADE STEEL MANUFACTURE IN CANADA.

M. J. BUTLER, managing director, the Armstrong-Whitworth Co. of Canada, takes exception to the statement made by several steel importers that high grades of steel are not being produced in Canada.

"While for a long time fine grades, such as vanadium steel and high tension machine steel, were not produced in Canada," says Mr. Butler, "they are now being manufactured at our Longueuil works. We hope that the imposition of this new war duty will not advance the price, but of course that will depend upon many circumstances which cannot be foreseen in war times. Our firm has started the manufacture of high-grade steel goods, and while we have accidentally fallen into the benefit of this unforeseen war tariff, it will undoubtedly aid in the establishment of our market, and we shall produce these special grades of steel in sufficient quantities to supply the Canadian market."

Mr. Butler stated that while the Armstrong-Whitworth people were not as yet producing steel tyres for locomotives, it was about the only thing they did not turn out. They, however, were manufacturing the special grade of steel required for steel tyres, and he had no doubt that before long, as a result of the new tariff, these tyres would be made in Canada.

"There is no doubt," said Mr. Butler, "that the new general war tariff will result in the production of many steel supplies in Canada which have hitherto been imported either from Germany, Great Britain or the United States, and Canadian business and Canadian labor will be the gainer thereby."

PISTON RING TROUBLE

Question.—We are at present turning out a quantity of piston rings varying from 3/16 in. to 5/16 in. in thickness by 6 in. in length, using high grade scrap, No. 1 Eglinton pig and Georgia coke, analysis of the latter herewith. The proportion of scrap to pig is 2 to 1. In almost every instance pin-holes and blowholes develop below the skin of the casting. We would greatly appreciate your interest in suggesting the cause and at same time a remedy for the trouble.—A. & McK.

No. 1 Eglinton Pig.

Silicon	3.000%
Sulphur	.015%
Combined carbon	.440%
Specific carbon	3.060%
Phosphorus	.793%
Manganese	1.800%
Iron (by difference)	90.892%

Coke.

Moisture	.30%
Volatile	2.17%
Ash	6.26%
Sulphur	.76%
Carbon	90.48%

Answer.—The following are two analyses which have given good results for piston rings:—

No. 1 Analysis.

Silicon, 1.50 to 2 per cent.; sulphur, 0.06 to 0.08 per cent.; phosphorus, 0.40 to 0.60 per cent.; manganese, 0.45 to 0.60 per cent.; graphitic carbon, 3.50 per cent.; combined carbon, 0.45 to 0.55 per cent.

No. 2 Analysis.

Silicon, 1.50 to 2.0 per cent.; sulphur, 0.08 per cent.; phosphorus, 0.30 to 0.50 per cent.; manganese, 0.45 per cent. to 0.60 per cent., and graphitic carbon low.

In these analyses, the high perecentage of silicon is for the lighter castings and low percentage for the heavier one. From investigation of your trouble it is apparent that there is an excess of sulphur in some of the materials in your mixture. Your pig iron is also too high in silicon, which causes you to use a large percentage of scrap, and as you seem to have no analyses of the latter, I think it is probably responsible for most of your trouble.

In making the moulds for these castings, the moulding sand should be worked as dry as possible. Use a good skim gate and cut a flow-off-riser on the opposite side of the mould from the gate, this allows the gas and steam that is generated when pouring to escape, and lessens the chance of blow-holes. See that the moulds are well vented and pour with good hot iron. The addition of one pound of 80 per cent. ferro manganese to every 100 lbs. of your present mixture will overcome your pin-hole and blow-hole difficulty as it will eliminate the gases that cause same. It should be added in the ladle, and stirred to mix it wtih the molten iron. This will give you a tough, close-grained iron that will machine up quite smooth. When slagging your cupola, use about 40 lbs. of good limestone to each ton of metal melted, as this also helps to throw off the impurities from the iron.—R. Micks.

Oxidising Sheets.—Oxidising steel or iron sheets so that they will have a uniform bluish color instead of the varying colors produced by the ordinary processes of annealing, is the subject of a patent—United States. 1,115,281, October 27th, 1914—granted to John E. Carnahan and Arthur J. Maskrey, Canton, Ohio. The ordinary sand-sealed annealing box is enclosed in another sand-sealed box, which constitutes the main point in the invention. By conducting the annealing in one box enclosed by another. it is found that the subsequent separation and oxidation results in a substantially uniform color throughout each sheet and the prevention of an excessively deep scale at or near the edges of the sheets. This is due to the more uniform temperature in the second box and to the fact that the sheets are better protected from the products of combustion.

Regina, Sask.—At a recent meting of the Board of Trade the following officers were re-elected: President, S. C. Burton; vice-president, E. A. McCallum; second vice-president, F. J. James, and secretary, L. T. McDonald.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW MULTIPLE SPINDLE BEVEL GEAR ROUGHING SHAPER.

OUR illustrations show a new multiple spindle bevel gear roughing shaper, designed and manufactured by Gould — Eberhardt, Newark, N.J. The principal function of the machine is to take care of the roughing or stocking out of bevel gears preparatory to having them finished on a bevel gear planer. As the stocking out consumes most of the time in cutting a bevel gear ordinarily done by the gear planer, and because the latter machine is so much more expensive than the roughing shaper, it will be seen that it is much more economical to have the roughing done on the roughing shaper, and the finishing on the gear planer.

The machine is particularly adapted to roughing out automobile differential steel bevel gears that have projecting hubs on the cone or small end of gear, and which would prevent them from being roughed in the ordinary simple disc cutter type gear cutting machine, as in this latter, the rotary cutter would be unable to cut the entire face of the gear on account of the hub interfering with the diameter of the cutter.

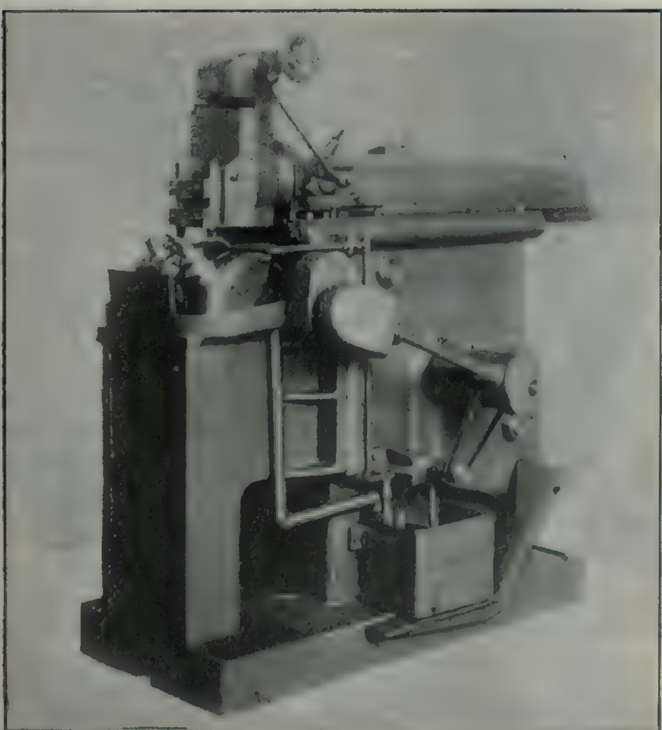
To accomplish the above work, the high-duty shaper lends itself satisfactorily on account of its high number of metal removing strokes, and it has been modified so as to allow one or two bevel gear blanks to be rigidly held at the proper angle and indexed at every return stroke of the ram. Again, the shaper head is automatically fed down at each stroke until the proper depth is reached, and then the feed is automatically thrown out and the blanks removed. The machine makes 100 cutting strokes per minute.

The most important feature of this shaper is the new style head which has been designed with a very efficient cam feed arrangement. Heretofore, the down or vertical feed to the head has been operated by means of a vertical feed screw, but in the present construction the feed screw has been eliminated and the cutting strains are thereby more effectively controlled by the cam feed construction. In addition, the amount of feed can be varied according to the location of cutting tool in the gear blank; that is, when the cutting tool is just entering the blank, the feed is greatest and, as the tool gradually feeds deeper into the blank, the feed is decreased. This not only relieves the machine and tool of the heavy duty which would otherwise be necessary if the downward feed were constant from start to finish, but it produces a higher finish job, as a very fine feed is automatically taking place when the tool is in full depth of tooth.

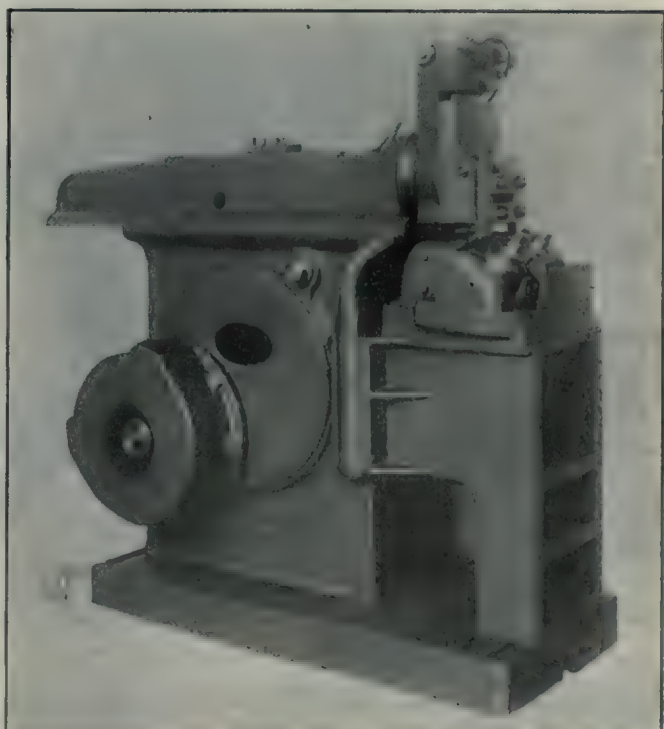
A new and efficient construction of main lever arm is employed, and is designed according to the first order of levers instead of the third order. The lever link is located on the top of the lever so as to take up the lost motion that takes place in operating the ram. Only two gears are used, and these are made of steel. The machine is driven by single pulley drive.

The principle of construction adopted is that of the high-duty shaper. The regular cross-head slide and table have been removed and a special work-head, with an indexing mechanism, has been substituted in their place. This work-head may be arranged so as to cut one or two gears at a time up to the capacity of the machine, with suitable means for holding the blanks rigidly and lubricating the tools, and so that they can be removed rapidly when finished and replaced with new blanks. The illustrations show two nickel steel 20-teeth, 6-pitch, ¾-in. face bevel gears being roughed out at one time, in 6¼ minutes each. They have projecting hubs, and to remove the chips that accumulate in the groove between the projecting hub and the inside face of the gears, two hook tools have been provided that fit in the groove under spring tension. These can be easily thrown out of position when taking off the gear.

The indexing of the blank from one tooth to the next consecutive tooth takes place at every return stroke of the



MULTIPLE SPINDLE BEVEL GEAR ROUGHING SHAPER.



MULTIPLE SPINDLE BEVEL GEAR ROUGHING SHAPER.

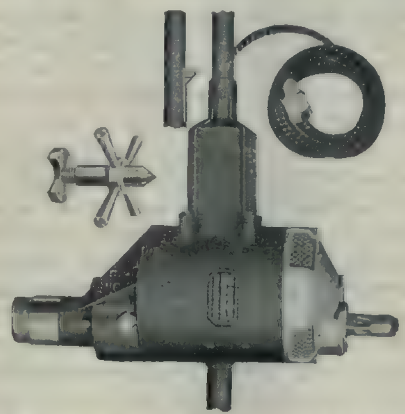
ram; that is, when the tool is clear of the work and, therefore, is positively controlled by the reciprocating of the ram. After the indexing has taken place and before the tool engages the work, means are provided to lock the work spindles, so that the blank is securely held while under cut. As the ram returns and the tool is out of the cut, the automatic vertical feed to head takes place, and so continues to operate until the feed cam has made one revolution and, in revolving, comes to the point where the feed started; then the head jumps out of the cut, and is ready to start on another set of blanks.

AUTOMATIC FACING TOOL FOR DRILL PRESS OR MILLING MACHINE.

WITH this facing tool it is possible to do work easily and rapidly on a drill press or milling machine, and which by ordinary methods is more or less difficult and slow. To spot face a boss or similar work has always been a somewhat difficult task, the ordinary flat spot-facing tools being hard to keep in order, besides it is difficult to get them started on the work, on account of getting under the scale of the iron. By the time the tool is forced through the scale, the cutting edge is ruined, and regrinding or replacing of the tool becomes necessary before the job can be finished.

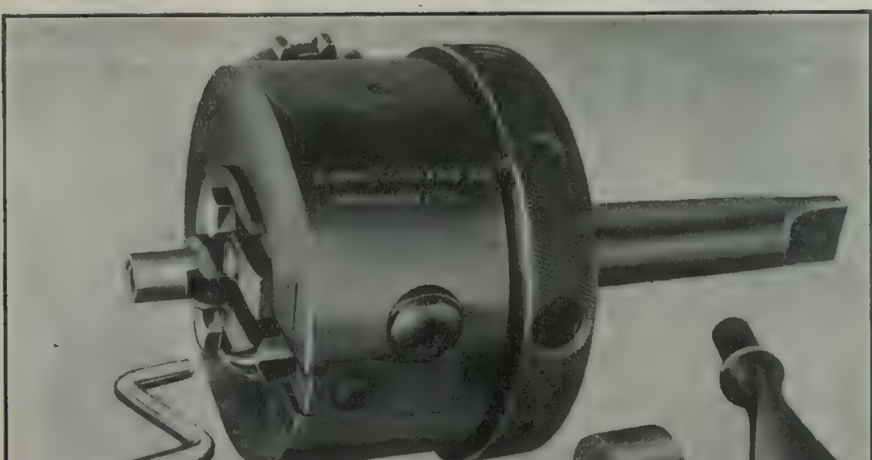
The purpose of this tool is to overcome the above difficulty. It operates on the same principle as facing on a lathe, the tool taking an ordinary lathe tool bit. The facing starts at the centre and the tool is fed outward, from which it will be noticed that the latter gets beneath the scale at the start and breaks it away as it is fed across the work. The tool bit is quite as easily taken out and sharpened as the tool bit is removed from any lathe tool holder and sharpened.

The operation of the tool is simple, the feed being effected by gripping the knurled ring with the hand and holding it, or a pin may be inserted in one of the holes in the ring and left to bear against the frame of the drill press. This operates the feed screw which moves the tool across the work, doing it at the same speed as a lathe would do it. On the bottom face plate provision is made for attaching a pilot which enters the hole in the boss to be faced and steadies the tool. On this pilot, thimbles can be placed to fit any sized hole.



HEAVY DUTY ELECTRICAL REAMER.

There is also a drill pilot, this being used where there is no hole. It is only necessary to put the drill pilot attachment on the tool, place it on the work and start it. The drill will make the centre hole and keep same in position while the facing is being done. This makes a quick operation. When this tool is used on a milling machine or boring mill with a rigid spindle, it is not necessary to use either pilot. The tool is fitted with a Morse tapered shank and fits any drill press spindle. It is furnished with either No. 3, No. 4, or No. 5 shank.



AUTOMATIC FACING TOOL.

The Mummert-Dixon Co., Hanover, Pa., are the manufacturers of this apparatus.

HEAVY-DUTY ELECTRICAL REAMER.

THE description and illustration refer to a recently designed reamer brought out by the Cincinnati Electrical Tool Co., Cincinnati, Ohio. It is wound for direct current only, and of the heavy-duty type, being ecpecially designed for bridge work, large shops and general construction work. It is made in three sizes, to ream holes 15-16 in., 1 1-16 in. and 1 3-16 in. respectively.

The motor is series wound, four-pole type, fully enclosed, and is air-cooled by means of a fan mounted on the armature shaft. The housing and gear case are of steel, giving special strength and insuring reliable electrical performance. The gears are made of chrome nickel steel, mounted on roller bearings, and are fully enclosed in the lower head of the reamer. They revolve in grease and are separated from the motor housing by means of a plate, thereby preventing oil and grease from getting into the windings.

High-grade annular bearings are used on both ends of the armature shaft, and the spindle thrust is taken up by means of a thrust ball bearing. The switch is of special design, of the quick make-and-break type, with release lever in one side handle. It is simple in construction and guaranteed against overload.

The brush-holders are mounted on fibre blocks and are highly insulated. The binding posts which hold the leads are designed so as to secure contact by means of compression spring, doing away entirely with the use of nuts and screws. The brushes are readily accessible by means of four removable window guards and can be replaced instantly, without removing the cap or disturbing any part of the machine.

The reamer is equipped with special type slip socket, which does away entirely with the drift-key and drift-holes in the spindle.

You cannot judge a system by the number of forms that are in use.

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Vol. XIII. FEBRUARY 25, 1915 No. 8

PRINCIPAL CONTENTS.

OUR IMPROMPTU SHELL INDUSTRY.

EACH succeeding week since the opening of 1915 has marked the gradual extension of our impromptu shell industry both in the number of plants filling contracts and in the disposition to duplicate and add to the latter feature. Those responsible for the administration of the various concerns, large and small, now employed in shell production, are not hesitating to meet the new and unique situation which has arisen and are providing the most modern machine tool equipment available, in order to prosecute the work satisfactorily, expeditiously and profitably.

It has been realized that the war in which we are engaged is not going to be over either soon or suddenly, and that, its being after all the meantime paramount consideration, we might as well begin to manufacture and export for German consumption just such commodities as first quality shrapnel shells. "Made in Canada but operative against Germany" should be expression of our earnest desire in every phase of this shell business right up to the last and perhaps least exacting requirement.

Canadian manufactured boots, blankets, etc., have been criticized, rightly or wrongly; on this however we are opinionless, these being beyond our province to discuss at this writing. Either of course contribute, if shoddy, to kill, although unfortunately, those affected would be our own kith and kin; but let us make no mistake in this shell business. The shells are being made to kill Germans, and let our mechanics see to it in addition to their workmanship being far removed from criticism, that they do not fail in this. The latest "Made in Germany," to wit the destruction of non-combatant lives neutral and enemy is but the further degree exemplification of the murderous tactics which German commercial warfare has waged the world over, and was mistaken for business acumen. To-day we see things in their true light, thanks to this European War, and ere the last shell has been made and fired and the last drop of blood has been spilt, we will have imbibed sufficient shrapnel spirit into our business nature and make-up, as to ensure that never again will "Made in Germany" over-run this fair Dominion as it has done in days gone by.

SHIPBUILDING BOOM DEVELOPING.

IN a recent issue we referred editorially to the shipbuilding boom as touching British yards, and pointed out that but for the lack of enterprise on the part of our prominent business men and the callousness of successive adminstrations towards the propagation of shipbuilding and marine engineering on our ocean coasts and ocean highways, we too would have been participants to our pleasure and profit.

Advices now to hand from the United States indicate that there too a shipbuilding boom has not only developed but is growing in intensity, more particularly of course as far as ocean coast and ocean waterway plants are concerned but, even in this connection, the authoritative statement is made that such conditions as are now in evidence affect favorably every State in the Union. In less than two months practically all of the United States coast yards have gradually filled up with orders, a circumstance which goes to show that the demand for both ocean and coastwise craft is in no way locational, either continental or national. American lake shipyards are not of course sharing in the revival any more than are those of our own, the work of both being largely confined to repairs and overhauling for the ensuing navigation season.

A few years ago, when the Canadian Navy fever was at its height, and when the clamor for a home-built product seemed like materializing, quite a few shipbuilding incorporations were recorded as the intitial step towards establishment of the various plants. With the exception, however, of that of Canadian Vickers at Montreal, all of them appear to have been still-born.

The capital outlay for almost any class of shipbuilding and marine engineering plant runs to a substantial amount and rarely if ever gives promise of quick investment returns, a circumstance that perhaps more than anything else has weighed with Canadian capitalists who had considered embarking in such an enterprise.

More institutions of the Canadian Vickers' nature are a requirement, if we would develop broadly and deeply, and strengthen our industrial foundations, and to bring this about mere enterprise promotions must be altogether eliminated.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	22 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 Plain	22 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.10
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.10
Beams and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates 1/4 to 1/2 in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 9 50
Copper, crucible	10 00	10 50
Copper, unch-bled, heavy	9 50	10 50
Copper wide, unch-bled	9 50	10 50
No. 1 machine compos'n	8 50	9 50
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	8 00
No. 1 brass turnings	6 00	6 75
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	4 50	5 00

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Feb. 13, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal
Standard				
1/4, 3/8 in.	64	49	....	....
1/2 in.	69	58	....	....
3/4 to 1 1/2 in.	74	63	....	....
2 in.	74	63	70	59
2 1/2 to 4 in.	74	63	73	62
4 1/2, 5, 6 in.	....	....	72	62
7, 8, 10 in.	....	....	68	57
X Strong P. E.				
1/4, 3/8 in.	57	46	....	....
1/2 in.	64	53	....	....
3/4 to 1 1/2 in.	68	57	....	....
2, 2 1/2, 3 in.	69	58	....	....
2 in.	....	....	64	54
2 1/2 to 4 in.	....	....	67	57
4 1/2, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
1/2 to 2 in.	44	34	....	....
2 1/2 to 4 in.	....	....	44	34
Genuine Wrot Iron.				
3/8 in.	58	43	....	....
1/2 in.	63	52	....	....
3/4 to 1 1/2 in.	68	57	....	....
2 in.	68	57	64	53
2 1/2, 3 in.	68	57	67	57
3 1/2, 4 in.	....	....	67	57
4 1/2, 5, 6 in.	....	....	65	55
7, 8 in.	....	....	61	50

Wrought Nipples	
4 in. and under	72 1/2%
4 1/2 in. and larger	72 1/2%
4 in. and under, running thread.	57 1/2%
Standard Couplings.	
4 in. and under	60%
4 1/2 in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake Copper, carload	$16 50	$16 50
Electrolytic copper	16 25	16 25
Castings copper	16 00	16 00
Tin	43 00	43 00
Spelter	10 50	10 75
Lead	5 00	5 65
Antimony	20 00	20 50
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 20
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4 1/2c per lb. off
Nuts, Hexagon, all sizes	4 3/4c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, 3/4-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7 1/2, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7 1/2, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7 1/2, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
1/8 in	$ .05 1/2	1/8 in	$ .12	1/2	$ .32
1/4 in	.06	1/4 in	.07 1/2	3/4	.35
3/8 in	.06	3/8 in	.07 1/2	1	.37
1/2 in	.08 1/2	1/2 in	.11	1 1/4	.52 1/2
3/4 in	.11 1/2	3/4 in	.15	1 1/2	.65
1 in	.17 1/2	1 in	.22	2	.91
1 1/4 in	.23 1/2	1 1/2 in	.30	2 1/2	1.37
1 1/2 in	.27 1/2	1 1/2 in	.36 1/2	3	1.86
2 in	.37	2 in	.50 1/2	3 1/2	2.30
2 1/2 in	.58 1/2	2 1/2 in	.77	4	2.76
3 in	.76 1/2	3 in	1.03	4 1/2	3.26
3 1/2 in	.92	3 1/2 in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4 1/2 in	1.27	4 1/2 in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.71
Linseed oil, boiled, single bbls.	0.74
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	35 & 5%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 80	$2 80
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 00	4 05
Apollo brand, 10¾ oz. (galvanized)	4 10	4 00
Queen's Head, 28 B.W.G.	4 25	4 45
Fleur-de-Lis, 28 B.W.G.	4 00	4 35
Gorbal's Best, No. 28	4 50	4 55
Viking metal, No. 28	4 00	4 10

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 21, 1915.—The situation in the iron and steel trade may be termed very quiet, indeed, only a small amount of business passing. In the United States, however, a decidedly better tone prevails, and in many lines unusual activity is being experienced, due largely to war orders received from the allies. That these conditions will be reflected here we have every reason to believe. More inquiries are being received, which indicates that conditions are about to improve, although it must be admitted that these inquiries have not so far led up to much business. Metals have been less active during the week, but prices manifest a tendency to stiffen.

The Steel Market.

Little business has passed during the week, but in a good many instances merchant bar iron has gone up in price, due to the new tariff. In structural shapes a similar increase in price has been made. Tool steel also has gone up in price. This will have a tendency to depress business for a while. However, in the steel business an early improvement is anticipated.

Pig Iron.

Throughout the province the demand for pig iron is very light indeed, and the new prices will tend to make it even more so. Foundries are doing very little, and until they commence operations on a

larger scale no improvement need be expected.

Machine Tools.

Conditions in the machine tool business undergo but slight changes from week to week, although the demand for tools used in the manufacture of shells still continues. These tools cannot, however, be had with a better delivery than three months at present. In other lines business is very dull. Machine tool supplies are moving in fairly large quantities owing to such a large number of shops being engaged in filling war orders.

Metals.

Copper prices seem to be stiffening somewhat, due largely to the tariff revision. Shipments of the metal to Europe still continue, there having been no curtailment due to the unsettled conditions around the British Isles. Tin has taken a jump of two cents per pound. Spelter and aluminum have also gone up in price. No special activity has been evidenced during the week, and the change in prices is due entirely to tariff factors.

Toronto, Ont., Feb. 23, 1915.—Business conditions show little change from last week when the effect of the higher tariff was just beginning to be felt. Adjustments are gradually being made, although some inconvenience is being experienced as a result of the necessary change in price schedules. All imported lines have been advanced, in most cases by an amount equivalent to the extra duty. There is also an upward tendency in the prices of Canadian-made products due to the higher cost of raw materials. Some lines have already been advanced while changes are being considered for others. The tariff revision has not as yet had, and it is doubtful if it will have, any unsettling effect on trade generally. To offset this possibility, however remote, there is every probabality of Canadian industries being stimulated, notwithstanding the increase in cost of raw materials. This will, of course, be more apparent as the trade of the country improves.

Municipalities are now calling tenders for annual supplies and some cities are proposing to proceed with more urgent work. There will, however, be considerable curtailment in civic works this year on account of the difficulty in obtaining the necessary funds. The Dominion Government's appropriations for public works throughout the country are liberal, considering the financial conditions, and they will help to relieve the unemployment situation to some extent.

There is a somewhat better feeling in the iron and steel trade, although there is not much business passing. Prices on domestic steel products have advanced. The machine tool business is quieter, but some nice orders for shell making equipments have still to be placed. There have been a number of price changes in machine shop supplies and further adjustments are anticipated. The metal markets are quiet and volume of business moving is light. Prices are keeping very firm but unchanged. The scrap metal markets are dull and prices unchanged.

Steel Market.

There is a little better tone in the market this week and a feeling prevails that the trade will benefit materially by the higher tariff as soon as general conditions improve. At the present time the building trade is dull and manufacturing interests are not by any means busy. The shell industry is, of course, using some steel and the volume of business for this purpose is increasing all the time. Prices on domestic steel products have advanced and quotations on bars and small shapes are now at $2.10 f.o.b. Toronto. Cold-drawn steel shafting has advanced, the discount now being 35 and 5 per cent. f.o.b. warehouse. Bolts, nuts, screws and rivets, etc., will no doubt advance, but prices are unchanged for the present.

The situation in the steel trade in the States is gradually improving and prices are firm. Galvanized steel and iron pipes have advanced $6 and $4 per ton respectively, while galvanized sheets have advanced $5 per ton, due to the exceptionally high price of spelter. Considerable uneasiness is developing as regards supplies of ferro-manganese, as it is feared that shipments of this alloy from England may be interrupted. Prices have jumped from $68 to $100 per ton, f.o.b. tidewater.

Pig Iron.

The market continues in a dull condition with light demand. The situation at Buffalo, N.Y., has improved. Prices have advanced in the local market owing to the tariff, and both Hamilton and Victoria brands are now being quoted at $19 per ton; representing an increase of $2.

Machine Tools.

There has been a lull this week in machine tool circles as regards equipments for making shells. Those concerns who have already purchased tools for this purpose and had them installed are getting their plants on a manufacturing basis. Orders for shells continue to be placed, and enquiries for tools are being received by local machinery houses. The industry is growing steadily and some further developments may be expected.

Supplies.

There is a better demand for machine shop supplies but the trade is in rather an unsettled condition owing to the higher tariff. On some lines all prices have been withdrawn temporarily until the necessary adjustments have been made. All imported supplies have advanced to meet the extra duty and some Canadian-made lines are higher on account of the increase in cost of raw materials. Milled screws, nuts and studs are unchanged but higher prices are expected. Tool steel may be expected to advance as prices have gone up in England, and in addition there is the extra duty to allow for. Drills and reamers are at present unchanged. Cotton wastes have advanced approximately ½c per pound on account of the duty on cotton, but wool wastes are, with one exception, unchanged. The new waste list is given in the selected market quotations. Turpentine has advanced 2c on account of the tariff, and linseed oil is up 1c a gallon. Leather belting is unchanged, but higher prices are probable.

Metals.

The market is quiet and there is little change in the situation. Business declined to some extent after the new duties went into effect but is gradually recovering. There have been no price changes this week but the markets are firm. The tin market is unsettled in London, due to the threatened submarine activities stopping shipments. The New York market is firm but quiet. The New York copper market is dull and unchanged; export business is easier, but the demand from brass mills continues heavy. Quotations in the local market are unchanged. The abnormal condition in the spelter market continues. Prices are still high and entirely nominal. The local market is unchanged. The lead market is firm and situation unchanged. The antimony market is quiet but very strong and indications point to higher prices. Aluminum is unchanged.

PROPOSED RAILROAD RATE INCREASE SCHEDULE.

THE Canadian railways under jurisdiction of the Government Commission have, through the Canadian Freight Association, forwarded to Ottawa a memorandum of the increased rates for which approval will be sought. The schedule in the memorandum is as follows:

Class Rates.

1.—That goods carried under Canadian freight classification ratings and class rates will be advanced 2c per 100 lb., first class, and 1c per 100 lb. fifth class; rates for other classes to be figured on the usual basis, subject to standard mileage class rates as a maximum.

Commodity Rates.

2.—On freight traffic carried on commodiiy rates, the following advances are proposed:

Coal and coke, 10c per ton.

Sand, gravel and crushed stone (except stone for fluxing), 5c per ton.

Billets, pig iron, wire rods, rails, crop ends, ferro silicon, iron ore concentrates, crude oxide of iron, mill cinder.

Present Rate.	Proposed advance.
$1.49 per ton, or lower	5c
$1.50 per ton to $2.49	10c
$2.50 per ton to $3.49	15c
$3.50 per ton to $4.49	20c
$4.50 per ton to $5.49	25c
$5.50 per ton to $6.49	30c

Pulpwood, cordwood, paving blocks, logs, stone, artificial stone.

Present Rate.	Proposed advance.
7½c or over	¼c
Over	
7½c but not exceeding 12½c	½c
12½c but not exceeding 17½c	¾c
71½c but not exceeding 22½c	1c
22½c but not exceeding 27½c	1¼c

Alum, tan bark, stone dust, cooperage stock, gypsum rock, shafts magnesite, final molasses, sale, drain tile, wire fencing, wrapping paper, cores, China clay, beer packages, charcoal nitre cake, hubs, spokes, mica scrap, pitch, sale cake, potatoes, wire netting, sulphur, in packages, cement, petroleum coke, grinding pebbles, rims, lime, lumber and forest products, rags, slag, wrapping paper, woodpulp, articles of iron and steel manufacture, C.L.:

Present Rate.	Proposed advance.
15c or lower	½c
Over	
15c but not exceeding 25c	1c
25c but not exceeding 35c	1½c
35c but not exceeding 45c	2c

Wood alcohol, excelsior, petroleum, marble, tar, ale and beer, gas liquor, rice and rice flour, C.L., sludge, tin cans, glass bottles, granite, green hides, sulphur, in bulk, metal shingles and sidings:

Present Rate.	Proposed advance.
25c or lower	1c
Over	
25c but not exceeding 35c	1½c
35c but not exceeding 45c	2c

Grain and grain products, flaxseed and beans:

Present Rate.	Proposed advance.
7½c or lower	½c
Over	
7½c but not exceeding 12½c	1c
12½c but not exceeding 17½c	1½c
17½c	2c

Rates on grain and grain products from Fort William, "all rail" and "lake and rail"; also from Bay Ports to Montreal will be advanced 1c per 100 lb. Rates from Fort William and Bay Ports, and Ontario points to points in the Maritime Provinces will be advanced 1c per 100 lb., plus the difference in the present and proposed arbitraries east of Montreal.

Sewer pipe as follows, viz.:—Where present rate is 7½c or lower, 1c per 100 lb.; where present rate is over 7½c, 1½c per 100 lb.

In connection with iron and steel articles; it is proposed to advance the L.C.L. rates to the proposed 4th class rates.

Rates on binder twine from Welland Ont., will be advanced from 1c to 4c per 100 lb., to correspond with similar advances made from twine factory points in the United States.

Proposed advance in rates on canned goods:—To Montreal and Ottawa, 1½c to 2½c per 100 lb. Points in the Maritime Provinces being figured by adding established arbitraries to the Montreal rate.

Cheese.—Rates on this commodity to Montreal have been advanced 2c per 100 lb., but not higher than the 4th class rates, which basis already applies from a very large territory.

Proposed to advance the present rates on live stock from 1c to 2c per 100 lb.; also corresponding advance is proposed in the rates on live stock to Buffalo, N.Y., and United States generally.

Proposed to advance rates on dry earth paints from Argalls, Champlain, and Red Mill, Que., to the 10th class rates.

Proposed to advance rates on the following commodities to correspond with the advance made in the 5th class rates, viz., paper, starch and glucose.

It is proposed to place acids on the 7th class basis.

Some commodities such as confectionery, corn oil, cotton piece goods, stoneware, gin, lard compound, leather and soap will be advanced to classification basis.

On certain commodities such as fertilizers, ore, stone for fluxing, sugar beets, beet pulp, etc., no advance has been proposed.

The above takes care of a great majority of the changes proposed. There are a few others of less importance which have been submitted to the board in detail.

ONTARIO BOILER INSPECTION.

THE Ontario Boiler Inspection Department has decided to take over control of the inspection of all boilers in use in the province. Legislation to this effect will be introduced during the present session. This stand is taken as a part of the Government policy to prevent any further boiler accidents, and means the elimination of all "inspections" by the engineers running the boilers. At present the Factory Act requires that every boiler be inspected annually, either by an engineer employed by the boiler insurance companies or by an engineeer with five years' experience. Where a boiler is not insured the man running it has generally inspected it himself.

Under the new bill, all boilers except those used in private residences must be inspected internally and externally under operating conditions at least once each calendar year. They must not be operated in excess of the pressure determined by the regulations and stated in the certificate of inspection issued by the department. The inspections will be made by departmental inspectors, or by insurance company inspectors as heretofore, except that all reports of inspections made by the latter must be submitted to the chief boiler inspector, under whose supervision the insurance companies will work. The reports sent in by the insurance companies will be in condensed form and will be filed at the department. Under the proposed bill, there is no intention to take any business from the boiler insurance companies, the idea being to insist that all boilers are inspected by a qualified inspector which has not always been the case formerly.

Trade Gossip

Orillia, Ont—The Board of Trade has elected the following officers: President, M. B. Tudhope, B.A.; vice-president, F. S. Lemis; treasurer, Nelson Ball; secretary, Harold L. Kearns.

The Erie Pump & Equipment Co., Erie, Pa., have appointed N. H. Brown to the position of sales engineer. Mr. Brown was until recently Chicago representative of the Bury Compressor Co.

Sarnia, Ont.—At a meeting of the Board of Trade the election of officers resulted as follows: President, Chester Belton; vice-president, W. J. McCormack; second vice-president, T. Grace; treasurer, R. H. Harvey; secretary, T. A. G. Gordon.

Montreal Lodge, C. A. S. E.—To celebrate the first anniversary of its foundation, the Montreal No. 1 Lodge, Canadian Association of Stationary Engineers, held a successful supper at the Terrapin Cafe on Feb. 19, when more than a hundred members and guests were present.

U. S. Copper Exports.—The Department of Commerce, Washington, announce that copper exports amounted to 7,142,042 pounds, valued at $994,520, during the week ended February 13. Of this, 5,077,497 pounds went to England; 672,107 to Italy; 448,146 to Scotland; 448,000 to Sweden; 251,969 to Norway, and 227,761 to Canada.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sarnia, Ont.—The Loughead Machine Co., has received a contract for ten thousand shells.

Owen Sound, Ont.—The McQuay Tanning Co. will improve its boiler house and power plant, etc., at an estimated cost of $15,000.

Sault Ste. Marie, Ont.—It is announced that the Algoma Steel Corporation have received an order for rails from South Africa.

Toronto, Ont.—Steel & Radiation is now working on a Government order of 50,000 shells and special machinery for their manufacture has been installed in the West Toronto plant.

Lindsay, Ont.—The Sylvester by-law has been withdrawn by Mr. Sylvester, who claims that the council had delayed the voting. It is probable that the ratepayers will not have a chance to exercise their franchise in regard to this concern.

Grand Forks, B.C.—Two more furnaces of the Grand Forks smelter have been blown in by Granby Consolidated making six sections of that plant now in operation. Within another month the two idle furnaces will also have been blown in, thereby placing the entire battery of eight in commission.

Sarnia, Ont.—The new factory of the Sarnia Metal Products Co. has been completed, and while all the machinery has not yet been installed, orders for the manufacture of metal roofing are being put through every day. Loyd Lott, sales manager, has had complete charge of the erection of the building and the purchase and installation of the machinery and equipment.

Electrical

Niagara-on-the-Lake, Ont.—The town council contemplate buying three small transformers.

Amherstburg, Ont.—The council are in the market for a number of street lamps and motors.

Renfrew, Ont.—The town have arranged for $16.845 in debentures for extending the street lighting system.

Petrolea, Ont.—There is a strong sentiment in Lambton county in favor of hydro-radials. A deputation representing various municipalities will visit the hydro-electric convention at Toronto on Feb. 24.

Chatham, Ont.—The hydro sub-station in this city will be erected by the Public Utilities Commission. All of the tenders opened recently have been rejected and the commission has decided to proceed with the work at once.

Sarnia, Ont.—J. J. Jeffrey, a representative of the Hydro-Electric Power Commission of Ontario, addressed a special meeting of the city council on Feb. 17. The hydro-electric question was discussed at length and much valuable information given regarding the local situation.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Winnipeg, Man.—No capital expenditures will be made this year by the light and power department on the second transmission line to the city power plant at Point du Bois, according to the plans now before the authorities. The establishment of synchronous condensers has eliminated the immediate necessity in that connection.

Windsor, Ont. — Sandwich Town Council has finally agreed to authorize the Ontario Hydro Commission to proceed with surveys and complete as soon as possible estimates for the installation of a Hydro-Electric Power system in the town. According to Engineer Jeffrey of the commission, the cost to instal a plant and wire the town will not exceed $1,200. Street lights will cost $12 a year each.

Ridgetown, Ont.—Engineers Jeffrey and Lawlor of the Hydro Commission met the Ridgetown town council and water and light commission last Thursday afternoon relative to the question of hydro-electric power for Ridgetown. The engineers will furnish an estimate of the cost of installing hydro here and also the expenses of operating the system.

Toronto, Ont.—A deputation of prominent farmers, representing Whitchurch Township, waited on the Provincial Hydro Commissioners on Feb. 17, at Toronto, requesting that a survey and estimate be prepared of a proposed new Hydro radial starting in Whitchurch and extending northerly to Georgian Bay. Chief Engineer Gaby assured the delegation that a survey would be made and submitted as soon as possible.

Municipal

London, Ont.—The city council will buy 800 water meters.

Moose Jaw, Sask.—The city council propose purchasing a quantity of cast iron pipe.

Sackville, N.B.—A by-law will be submitted to raise $40,000 for water and sewerage purposes.

North Bay, Ont.—The by-law to raise $60,000 for road improvements was defeated by the electors on Feb. 15.

Durham, Ont.—The council will take over the local power plant owned by N. McIntyre and will spend $10,000 on renewals and extensions.

Toronto, Ont.—The Board of Control has decided not to proceed with the construction of the bridge at Moore Park which would have cost $345.000.

Kamloops, B.C.—The estimates of the Dominion Department of Public Works, include $29,000 for a drill hall, and $75,000 for a public building here.

Kingston, Ont.—The city council have requested the city engineer and his staff to hand in their resignations. It is proposed to reorganize the engineering department .

Ottawa, Ont.—The Board of Control has decided to ask for special legislation to spend $180,000 on the Ottawa-Prescott

20" Water Tool Grinder

Quality Grinders

"KEEP SHARP"

These words stamped on milling cutters apply equally to all tools. To get *results,* tools must be kept in A1 condition. How is your shop equipped in this respect?

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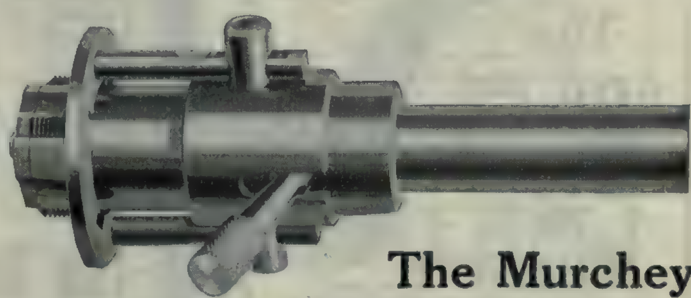
Shrapnel Work Calls for This Collapsing Tap



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Made in all sizes from 1" to 12". Tripping ring is set at the point where it will come in contact with face of work when the required length of thread is made. Chasers then automatically collapse and tool is withdrawn. Expanded by lever handle and another operation started. This all counts for speed, convenience and accuracy—vital essentials on big runs of work.

Shrapnel Manufacturers Are Finding This Out

The inquiries and the orders we are receiving prove that those concerns who are making shrapnel are quick to see the advantages of using Murchey Collapsing Taps in securing their BIG PRODUCTION at the LOWEST COST, WITH THE GREATEST CONVENIENCE and in the QUICKEST TIME. Fall in line. Use Murchey Collapsing Taps in YOUR shop, working on steel. Get the manufacturing costs of shrapnel down to the lowest figure.

Murchey Service is ready to show you definitely just where and how much these tools can save on your work. Ask for the New Catalog; and, better yet, send us blueprints. We can adapt our tools, by modification, to meet your particular requirements.

Murchey Machine & Tool Co., 34 Porter St., Detroit, Michigan

highway, and in the event of the necessary legislation being secured, the ratepayers will be asked to vote upon the matter.

Toronto, Ont.—Tenders for the new incinerator have been opened by the Board of Control, and are as follows: Heenan & Froude, "A" $77,000; "B" $57,000; and the Canadian Griscom Russell Co., Montreal, "A" $75,000, "B" $56,000.

Newmarket, Ont.—The by-laws authorizing the municipality to enter into a contract with the York Radial Co. for a supply of a minimum of 500 horse-power, and to float an issue of debentures for $15,000, were both carried last Monday by large majorities.

Transcona, Man.—At a meeting of the town council held recently a draft bill was presented by E. Bailey Fisher, solicitor, petitioning the Provincial Government for powers to bonus industries to the extent of $100,000 or less. The bill was approved by the council, with several amendments.

Welland, Ont.—The fire, water and light committee has been authorized to call for tenders for the installation of a fire alarm system and report to council. Mr. McMillan, chairman of the committee, said that it was doubtful if the $5,000 voted would be sufficient. The fire alarm debenture by-law, passed by the ratepayers in January was given a third third and final reading.

Montreal, Que.—Hering & Fuller, engineers, of New York, have recommended to Controller Cote that the present filtration system should be supplemented by a mechanical filtration plant working in conjunction with it. The engineers reported that a plant of sufficient capacity could be installed for about $2,400,000. A plant capable of handling 15 million gallons would be necessary.

Ottawa, Ont.—Dr. McCullough and F. C. Dallyn, chief sanitary engineer of the Provincial Board of Health, will visit Ottawa for the purpose of looking over the plans and site of the proposed line to Lemieux Island. The Ottawa deputation was emphatically told that the Board will not approve of any Ottawa river water scheme as a permanent solution of the water problem of the Capital, and, if approved, the overland pipe scheme will be constructed for the sole purpose of removing the insurance surcharge. J. B. McRae has prepared plans for the Lemieux Island scheme, which is an alternative to the proposed pipe line to Thirty-One Mile Lake recommended by Sir Alex. Binnie and Dr. Houston.

Victoria, B.C.—Votes by the Dominion Government for public buildings in British Columbia include the following:—Ashcroft, public building, $25,000; Cour-

Classified Advertisements

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POSITION WANTED AS ENGINEER OF steam or electric power plant; familiar with high-class equipment, including different types of engines, turbines, boilers and electric generators and transformers. Over 20 years' wide experience, good records, disengaged, go anywhere. Address "Engineer," Canadian Machinery. (8)

FOR SALE

3" x 36" JONES & LAMSON LATHE. 20" x 8" geared head single pulley drive. Also quick-change gear Prentice lathe. 16 x 6 Reed lathe. 3—5A Potter & Johnson automatics. All in excellent condition, guaranteed. Dominion Machinery Company, 82 Adelaide Street East, Toronto.

tenay, public building, $20,000; Coquitlam, public building, $20,000; Dominion public building improvements, repairs, etc., $17,000; Fernie, drill hall, $20,000; Ganges Harbor, public buildings, $5,000; Golden, public building, $20,000; Grand Forks, public buildings, $5,000; Greenwood, public buildings, $10,000; Kamloops, drill hall, $29,000; new public building, $75,000; Kelowna, public building, $30,000; Merritt, public building, $25,000; Mission City, public building, $20,000; New Hazelton, public building, $9,500; North Vancouver, drill hall, $10,000; Penticton, public building, $20,000; Prince Rupert, drill hall, $8,000; public building, $147,000; quarantine station, $80,000; Revelstoke, public building, $50,000; Sidney, public building, $17,000; Trail, public building, $20,000; Vancouver, new detention building, $150,000; public building (new), improvements, $6,000; postal station B, $124,000; postal station, Mount Pleasant, $70,000; Dominion buildings, improvements ,repairs, etc., $5,000; South Vancouver, postal station, $60,000; Victoria, new drill hall, $150,000; observatory, $75,000.

Ottawa, Ont — The following are amongst the appropriations for public works in Ontario made by the Dominion Government:—Almonte post office, addition and alterations, etc., $4,000; Burk's Falls, public building, $20,000; Campbellford, public building, $16,000; Copper Cliff, public building, $15,000; Cornwall, public building, improvements, $5,000; Dominion public buildings, improvements, repairs, etc., $35,000; Eganville, public building, $10,000; Kemptville, public building, $3,000; Morrisburg, public building, $20,000; Napanee, drill hall, $36,000; New Liskeard, public building, $20,000; Ottawa, departmental buildings, fittings, etc., $75,000; Ottawa, departmental buildings, Langevin block, new elevators, etc., $25,000; Ottawa, customs building, $600,000; Ottawa, new drill hall, $50,000; Ottawa, Parliament Buildings, improvements, $10,000; Ottawa, post office, new elevator, etc., $9,000; Ottawa, Parliament and departmental buildings, re-wiring, etc., $70,000; Ottawa, public buildings, Pembroke drill hall, $26,000; Pembroke, public building, addition and improvements, $4,000; Perth, public building, $25,000; Peterborough, new public building, $47,000; Prescott customs house, new roof, etc., $1,000; Smith's Falls, public building, enlargement and improvements, $12,000; Sturgeon Falls public building, $7,000; Sudbury, public building, $35,000; Sturgeon Falls, wharf extension, $3,000.

Walter Stuart, of Lucknow, Ont., owner of the electric light plant and planing mill, died on February 18.

Tenders

Montreal, Que.—J. E. Aldred told shareholders of the Shawinigan Co., recently that construction in connection with the subsidiary enterprise, Three Rivers Traction, would probably be started this spring and that the system would embrace six miles of track.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, City Hall, up to Tuesday, April 13, 1915, for the supply of automatic valves and check valves. Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall.

Windsor, Ont.—The City of Windsor has for sale and invites tenders for the purchase of machinery and electrical apparatus, consisting of engines, boilers, heaters, steam pumps, shaft, pulleys, belts, generators, arc lamps, switchboard, quantity of copper wire, etc. Complete specifications may be obtained by application to undersigned, by whom tenders will be received up till Tuesday, March 2. M. A. Dickinson, acting clerk.

Ottawa, Ont.—Tenders will be received by R. C. Desrochers, secretary of the Department of Public Works, Ottawa, until March 1, for the following supplies for departmental dredging plants in Nova Scotia and New Brunswick:—Brooms and brushes, chain, hardware, hose, oils and greases, packing, paint, paint oils, etc., Manila rope, wire rope, steam pipe, valves and fittings. Specification, etc., at the offices of J. K. Blenkinsop, superintendent of dredges, St. John, N.B., and the Department of Publis Works, Ottawa.

Hamilton, Ont.—Sealed tenders will be received by the chairman Board of Control, City Hall, up to Monday, March 1, 1915, for the supply of the following material and equipment:—Castings (ordinary and special), iron pipe, hydrants, valves, extension boxes, hardware, lead pipe, pig lead, rubber hose, rubber boots, road oil, flux, fuel oil, coal oil, gasoline, concrete and garbage duck covers, brass brooms and sectional sweepers, brass work for water department, sewer brick. Specifications can be obtained at the office of the secretary of the Works Department. S. H. Kent, city clerk.

St. Catharines, Ont.—Tenders will be received by the architect until Monday, March 15, 1915, for all trades required for the erection and completion of a new Collegiate Institute to be erected in St. Catharines, Ont. A complete set of plans and specifications may be seen at any reasonable time at the office of the architect, 46 Queen street, St. Catharines, Ont. Contractors wishing to obtain

a set of plans and specifications for estimating may do so upon application to the architect and depositing with him in marked cheque for $25.00. A. E. Nicholson, O.A.A., architect, St. Catharines, Ont.

Trade Gossip

Nicholson File Co.—We are advised by the Nicholson File Co., Port Hope, Ont., that the statement appearing in their advertisement of our Feb. 11 issue—"A $60,000,000 output yearly makes them economical," should read instead, "A 60,000,000 output yearly, etc."

Vancouver, B.C.—The British Columbia mills announce that through the C. P. R. and Government purchasing agents the United Kingdom has placed an order for 3,000,000 feet of railway ties and bridge timbers, the order to be filled in thirty days. Nine mills are handling the order.

Woodstock, Ont.—The Board of Trade has elected the following officers: President, W. T. Taylor; vice-president, W. D. Hobson; council, J. E. Fidler, J. A. McKenzie, T. W. Gray, W. S. West, E. W. Nesbitt, A. W. Muir, P. S. Connolly, J. G. McBeth, Col. White, A. W. Moore, I. B. Terryberry and C. I. Stewart.

Brantford, Ont.—The industrial condition is picking up here. The Brantford Cordage Co. have started overtime. The Massey-Harris Co. is now employing 600 men. The Waterous Engine Works state that conditions were approaching normal. The Verity Plow Works is now running ten hours daily in place of nine.

Saskatoon, Sask.—At the annual meeting of the Board of Trade held on Feb. 10, the following officers were elected: President, Malcolm Isbister; vice-president, J. H. Holmes; treasurer, A. F. Lenon; council, E. W. Duval, J. C. Bell, C. T. Woodside, S. W. Johns, Alan Sproatt, S. S. Stearns, George Sillers, J. D. Gunn, C. L. Tanner, W. P. Kirkpatrick, S. E. Fawcett and W. A. Coulthard.

Nickel Commission.—The Ontario Government announce through the Hon. G. Howard Ferguson, Minister of Lands, Forests and Mines, that a commission would be appointed to investigate the nickel situation in the province. The Government's decision came in the form of a statement dealing fully with the suggestions that nickel can be refined in Ontario. The names of the commissioners to consider the nickel problem have not been made public.

Lethbridge, Alta.—The Board of Trade has elected the following officers: President, G. R. Marnoch; vice-president, R.

T. Brymner; sec.-treasurer, D. J. Hay; council, D. E. Harris, G. F. Bletcher, S. J. Shepherd, J. B. Wilkie, F. W. Downer, J. B. Turney, J. Torrance, J. W. Bartlett, W. H. Fairfield, W. J. Nelson, G. W. Green, G. A. Wilson, Dr. C. F. P. Conybeare, K.C. W. M. Harris, J. C. Reid, H. J. H. Skeith, S. S. Dunham.

British Manufacturing Exhibition. — An exhibition of British manufactures is to be held at the Agricultural Hall, London, England, from May 10 to May 24 next, with the approval of the Imperial Board of Trade. The exhibition will comprise toys, fancy goods, earthenware goods, glassware, cutlery, electro-plate, clocks, common jewelry, paper and stationery. Buyers leaving Canada for the United Kingdom in time to see the exhibition, should communicate with C. Hamilton Wickes, British Trade Commissioner to Canada, 3 Beaver Hall square, Montreal.

Northern Ontario Power.—The annual report of the Northern Ontario Light & Power Co., which operates power plants on the Montreal River and the Matabitchouan, and which supplies light and power to the Cobalt mining district, shows gross earnings in 1914 of $875,195, an increase of $2,685, or 3 per cent. over 1913. Operating expenses were $211,023, a decrease of $3,079, or 1.4 per cent., leaving net of $664,172, an increase of $5,764, or 9 per cent. Bond interest took $273,360, leaving net surplus of $390,812, an increase of $4,667, or 1.2 per cent. more than in the previous year. After preferred dividend of $142,758, a surplus of $248,054 remained, an increase of $4,667, or 1.9 per cent. more than in 1913.

Dominion Steel Corporation.—J. H. Plummer, president of the Dominion Steel Corporation, states that the company is selling its entire output of steel billets in Great Britain, which is an active buyer. Mr. Plummer says the report that the Corporation is now operating its plant almost to capacity is not correct. The three blast furnaces and the open hearth plant are being operated, the company actually operating on a ratio of about 55 per cent. of its capacity. Prices for steel products have improved somewhat of late, but the advances are not sufficient to make up for the rise in freight rates, which are several times those obtaining in normal times owing to the difficulty of obtaining bottoms.

Apprentice System at Lynn Works of General Electric Co.*

By Theodore Bodde

The advantages accruing from the employment of specially trained men is generally recognized by at least the larger manufacturing and other corporations, and to secure and maintain the necessary quota of such employees, an apprenticeship course forms part of the works organization. Last week we featured the scheme of a Canadian railroad motive power department, and in the present instance that of a mammoth U.S. Corporation is outlined.

IN a large factory building belonging to the General Electric Co., at West Lynn, Massachusetts, there exists a unique school of practical electrical and general technical knowledge; unique, because it combines and mingles intimately the practical factory atmosphere with the theoretical ether of science.

This educational institution gives practical instruction through factory work and theoretical knowledge through class room lectures. The class room work is so arranged as to occupy slightly less time in years than the practical work. If a student therefore fails to pass in one of the classes and is obliged to repeat it, he can finish all classroom work within the prescribed time limit of apprenticeship. The institution provides for young men with no more than a grammar school education as well as for high school graduates. The grammar school graduates are placed in the so-called apprentice school, while the high school graduates enter the engineering school. They are selected out of a large number of applicants.

System Outline.

In the apprentice school, the young men are developed into efficient skilled workmen, assistant foremen and foremen, and tool designers. In the engineering school they are converted into efficient practical engineers. The classroom work of the apprentice school stretches out over a period of nine terms of 14 weeks each. That of the engineering school covers a period of seven terms of 14 weeks each. There are three terms in each school year. The teaching staff consists of six instructors and one superintendent.

The foregoing outlines in a general way the system of this technical school and we will now consider some of the different principles and methods which are followed in the electrical department, in order to give a general idea of the system. To the apprentices one term of electricity is given, while to the students of the engineering school five terms of electricity are allowed.

Principle of Concrete Representation.

The first principle followed, for the purpose of effectually impressing the mind of the young man, is that of concrete representation of the different truths which are taught him. The reason for this lies in the fact that these young men have generally left school at an early age. Consequently, theory and its demands on the imagination are almost unknown to them and the imagination has not been trained to its full strength. On the other hand, having been in contact with matter and material things during the greater part of their lives, they can, with no difficulty whatever, see through material things and material representations, where they would be powerless were those representations only abstract ones. Therefore, it is through this concrete method of representing things that one must appeal to them.

Technical Education Defined.

Technical education consists in impressing on the mind the relations between natural phenomena; in other words, in leading the pupil to discover the links connecting different facts. In popular language this discovery is expressed by the saying: "I see," which means nothing else than "I see the link; I understand;" for when we see a thing we understand it. Now if this connecting link can be made visible by means of really visible things, instead of by things which are only visible through an effort of the imagination, we shall be able to make all things understandable to those whose imagination is not strong enough for that effort, and technical education for the masses will become possible.

It is true that education consists also in training that very effort of the imagination which is needed for the concentration of the mind. It is this branch of education which produces thinkers. It produces, however, perfect fruit only when applied to the very few who have a natural aptitude for thinking. The large mass take up only facts and relations and become effective tools, but very few among them become thinkers and leaders. In our present civilization it is well that this should be so. At the same time we may long for some future in the advancing ages when this condition will no longer be necessary, and everybody will be trained for the beauty and development of himself and of the race.

At present, the world needs many tools for its material growth, and the General Electric Co., which, is itself a small world, daily feels the need for efficient tools, and all efforts are exerted in this direction. If, now and then, thinkers are mixed among the tools, they will be recognized sooner or later, and will step out of the mass through their own efforts. Hence, for the present, the methods of education should not be molded for them but for the large masses. Neither should the methods of education be molded for the other extreme, the dummy. In the General Electric Co. apprentice and engineering school, the dummies are eliminated while passing from the lower classes to the higher ones, and this is done by a simple weeding out process, through keeping a close observation and a just record of their doings and progress throughout each term. An educational committee meets every week and carefully eliminates the chaff from the wheat, the result being that the higher classes are very nearly perfect. The following are some examples of the concrete representation of things as applied in the electrical engineering department of this school:—

First Term.

Throughout the first term, the text book of W. H. Timbie, "Essentials of Electricity," is used. The beginners have special trouble in grasping the idea of line drop in transmission lines and other similar very real and important phenomena in power transmission. The reason is obvious. Transmission lines are so large that they have never been grasped in their entirety in the imagination of the student; they are too long to be contained in the narrow space of his vision.

In order to overcome this difficulty, a miniature transmission line was made, reproducing in every way the phenomena of a large power transmission. The lines are made of thin resistance wire and are stretched across the whole length of two blackboards which run along the wall of the classroom. A set of incandescent lamps at about the middle of the line produces one load, and another set of lamps at the end of the line produces another load. The beginnings of the wires are switched to two

*From General Electric Review.

binding posts, between which are 275 volts d.c.

By varying the number of lamps, different loads are put on the line at different points, thus producing different currents and different line drops in the sections of the line. These values are measured in a direct way by the students. This gives them practice in the manipulation of d.c. voltmeters and ammeters. The readings are then written down in chalk directly over the corresponding sections on the blackboard. From these results, calculations are made relating to power loss in the different sections of the line, voltage on the loads, power delivered to the loads, total power transmitted, etc. All these calculations, written down again on the blackboard over the corresponding part, are then finally checked up by means of direct measurements.

Getting Results.

The three-wire balanced and unbalanced systems are also reproduced in miniature by the same means, and the general run—first measurements, then calculations, and at last checking up by other measurements—is essentially the same as before. It is remarkable what good results this method of teaching has produced.

In a latter part of the term the d.c. generator and motor phenomena are illustrated by means of an old fashioned bipolar shunt wound dynamo which has been fixed for the purpose and provided with a flywheel. This makes possible the illustration of the counter-electromotive force which exists in a running motor.

Suppose the dynamo has been connected up at the end of the above described miniature transmission line, and runs as a motor. A set of lamps on the same transmission line shows its bright lights as a result of the power which it takes from the same source. If now the double-pole switch between the binding post and the transmission lines is suddenly opened, the motor, because of the inertia of its flywheel, will become a generator, and the lamps will still show their bright lights, this time, however, taking their power from the dynamo side; for the current on that side is reversed, as is clearly shown by means of an ammeter. The voltage on the line can be measured at the instant that the double-pole switch is opened, which serves to illustrate in a clear and real way the counter-electromotive force which existed an instant before while the dynamo was still running as a motor.

Thus the student becomes familiar with all the secrets of the dynamo. Even this counter-electromotive force, so often the stumbling block to beginners, becomes visible, almost palpable to them, and impresses itself on their minds. The measurements of voltage and currents, in relation to the speeds through which the flywheel passes, are then written down, calculations are made and again experimentally verified, and it is thus that the different phenomena enter into the mind almost without effort; for the student is interested in these different operations from start to finish, and is not tired out by an undue effort of the imagination. The channels between his senses and his mind are wide open, and the knowledge enters without effort.

Second Term.

During the second term of electricity, Swoope's textbook, "Lessons in Practical Electricity," is used. This textbook is rich in material, and in this lies its great merit, for it offers many topics to be treated and talked about in the classroom. It describes many experiments, and to follow these descriptions requires a certain amount of the student's imagination. It is to be noticed again that the student of the engineering school is a high school graduate and has had his imagination trained originally to a greater extent than has the average aprentice. As the time is limited, considering the large scope of the book, this term is mainly devoted to theory, though here and there concrete illustrations are made if the described experiments of the book do not convey the fact clearly enough to the mind.

Third Term.

The third term of electricity is devoted entirely to experiments and laboratory work. Large d.c. and a.c. dynamos and the necessary instruments are put into the students's hands, and under the direction of their instructor they make the usual practical tests relating to voltage, speed, load, losses and efficiency. It is surprising how quickly the students get hold of this term's work and of the right way of doing things. Their enthusiasm and interest is very visible in the neatness with which they make up their reports. Some of these are almost works of art, so carefully are the sketches drawn and the curves traced.

After this term of heavy practical work, the student goes back again to pure theory. Two terms of advanced electricity along the lines of Franklin & Esty's textbook of electrical engineering now follow. During this time the student has ample occasion to verify and think theoretically over the different points and phenomena which have come up during the former term, and thus the last foundation stone of electrical knowledge is deposited in his brain.

The classroom in which the student gets these advanced courses of electrical engineering is in the laboratory, so that the whole atmosphere is impregnated with the practical developments of the great industry. Dynamos, rheostats, and all kinds of motors look at him from all sides while he ponders over some intricate problem, and like real friends suggest ideas to him. The walls carry charts illustrating such useful rules as the famous Fleming's three-finger rules for motor and generator directions, and the unconscious daily look at these charts produces on the student's mind a lasting impression, in the same way as in daily life the advertising poster impresses the public mind. If there is any formula, any figure, difficult yet useful to remember, there is no better and easier way of mastering it in one's memory than by posting it in some conspicuous place to which the eye is turned every day. These repeated impressions will leave their mark without requiring any acrobatic effort of the brain.

THE ENGINEERING FOUNDATION

ON January 27, 1915, there was held in the auditorium of the Engineering Societies Building the inaugural exercises of the Engineering Foundation, established by the United Engineering Society. The initial gift to the Foundation of $200,000, made by Ambrose Swasey, past-president of the American Society of Mechanical Engineers, was formally accepted at this time. So far as known this is the first instance of a foundation devoted to engineering purposes and this meeting constituted an appropriate tribute to the generous gift which made its inception possible and gave opportunity for expression of the satisfaction and approval which is felt by engineers everywhere at the establishment of a means for forwarding the work of the engineer along the broadest possible lines.

Gano Dunn, president of the United Engineering Society and past-president of the American Institute of Electrical Engineers, acted as presiding officer, and on the platform were seated representatives of the three societies constituting the United Engineering Society, and of the American Society of Civil Engineers. Members of the four societies and many friends interested in the profession composed the audience.

In his address, the chairman reviewed the history of the Engineering Societies Building, the purpose of the United Engineering Society, and the formation of the Engineering Foundation made possible by Mr. Swasey's gift.

Mr. Swasey very briefly expressed his appreciation of the cordial manner in which the announcement of his gift had been received. He believed that the

meeting was also evidence of the appreciation felt of what had been accomplished by the United Engineering Society and the work which they had done in planning and bringing about this Foundation. It is a very simple matter to throw a few shovelsful of coal under the boiler, he said. We must have fuel if we would have power, but to the engineers who designed the boiler and the engine, and who so proportioned them and so correlated them that the products of combustion can be used to greater advantage than ever before for the benefit of mankind, the greater credit belongs.

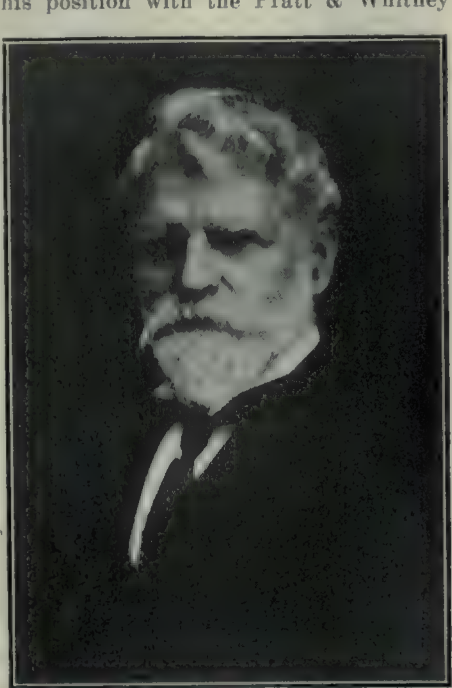
Ambrose Swasey.

Ambrose Swasey, the donor of the initial fund for the Engineering Foundation, is widely known as a member of the firm of Warner & Swasey of Cleveland, Ohio, prominent machine tool builders and the foremost builders of telescopes in the world. Among the instruments which they have designed are the famous Lick, Yerkes, and the United States Naval Observatory telescopes, as well as the great 72-inch reflecting telescope for the Canadian Government, which is now under construction.

Mr. Swasey is known also, in addition to his engineering achievements, for his practical efforts towards scientific education and the advancement of the profession. His gift for the establishment of the Engineering Foundation is in line with these undertakings, which may be destined to outlast his fame as an engineer. Mr. Swasey gave the handsome observatory to Denison University at Granville, Ohio, and the science building for the University of Nanking and the Young Men's Christian Association College now being erected in China, were made possible through his gifts. He has also as president of the Warner & Swasey Company, interested himself earnestly in the establishment and conduct of its school of apprentices, and indeed the weight of his influence is to be found in every project tending to the development and encouragement of the human element, helping men to help themselves.

Mr. Swasey was born in Exeter, N. H., his ancestors being among the early settlers of New England, coming to American in 1638. He received his education in the 'Little Red School House' of the district, and his after life has shown that the seed sown by the old schoolmaster fell upon good ground. At the age of eighteen he entered upon the machinist's trade in Exeter, and in 1870, in company with his present partner, Worcester R. Warner, he left the granite hills of his native State to go into the employ of the Pratt & Whitney Company, at Hartford, Conn. His energy and ability soon became manifest to his new employers, and his aptness in the solution of mechanical problems was so thoroughly appreciated, that the remark, 'Send it up to Swasey,'' was a common one with them.

While in charge of the gearing department, he invented and perfected the epicycloidal milling machine for producing the true theoretical curves of the teeth of gears ,and a few years later he made another advance step in the solution of that difficult problem, inventing an entirely new process for generating and cutting spur gears, which proved a practical solution of the very mportant theory of the interchange system of gearing. In 1880, Mr. Swasey resigned his position with the Pratt & Whitney



AMBROSE SWASEY
Past President American Society of Mechanical Engineers and Donor of the Initial Gift to the Engineering Foundation.

Co. and, together with his present partner, established in Cleveland, O., the business which has since grown to such large proportions. Mr. Swasey's inventive and mechanical genius has emphatically manifested itself in the design and construction of the fine machine tools and astronomical instruments made by his firm.

The manufacture of meridian circles, transits and other astronomical instruments of extreme accuracy and precision has formed a large part of the firm's work, and in the designing of all these instruments Mr. Swasey has taken an important part. For graduating the fine circles of these delicate instruments it was necessary to have a circular dividing engine, and as there was no instrument in the country of sufficient accuracy, the problem was taken up of designing and perfecting such an engine which, when completed, was capable of dividing circles automatically up to 40 inches in diameter with an error less than one second of an arc, probably the most accurate circular dividing engine ever constructed.

Mr. Swasey is the inventor of a number of instruments used by the Government in its coast defense including several improvements in the construction of range finders.

Many honors have come to Mr. Swasey for his work and achievements. He is a past president of the Society, a member of the Institution of Mechanical Engineers of Great Britain and of the British Astronomical Society. He is a Fellow of the Royal Astronomical Society, is past-president of the Cleveland Engineering Society, and, in 1900, received from the French Government the decoration of the Legion of Honor for his achievements in the design and construction of astronomical instruments.

He was a member of the Jury of Awards of the Nashville, the Pan-American and the St. Louis Expositions, and vice-president of the Jury of Awards of the Jamestown Exposition. In 1905 he served as president of the Cleveland Chamber of Commerce, and the same year the degree of Doctor of Engineering was conferred upon him by Case School of Applied Science. Mr. Swasey was married October 24, 1871, to Lavina D., daughter of David and Sarah Ann (Dearborn) Marston, and he and Mrs. Swasey had traveled extensively, up to the time of Mrs. Swasey's death early in the year of 1913.

Steam Sanding Apparatus.—In conjunction with steam sanding apparatus, states the Railway News, a plan has been introduced wherein a valve is arranged so that superheated steam is used as long as it is available, but on failure of the supply, the ejector is automatically supplied with saturated steam. Superheated steam is supplied to a casing by one connection and saturated steam by another, which is normally closed by a piston valve moved by a spring, and by the pressure of the superheated steam on the head of the valve. The superheated steam passes through ports in the valve into a chamber, and thence, when the manually operated valve is open, through a chamber and valves into a chamber communicating with the ejector pipe. When the supply of superheated steam fails, the saturated steam automatically opens the piston valve and passes to the ejector pipe.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.—IV.

By Albert A. Dowd.

THE development of the gas engine in recent years has progressed to such an extent that it is adapted in its many forms to a great variety of uses. The automobiles which we see gliding along so smoothly and silently on our streets and highways would not have attained their present degree of perfection had it not been for the development of this engine. The motorcycle which dashes by us with more than the speed of a racehorse, and the aeroplane which soars overhead, would not have been possible without the power derived from this wonderful piece of mechanism. On the water we see craft of every description impelled by the same force, from the fisherman's dory to the pleasure yacht. The farmer of to-day brings his produce to the market

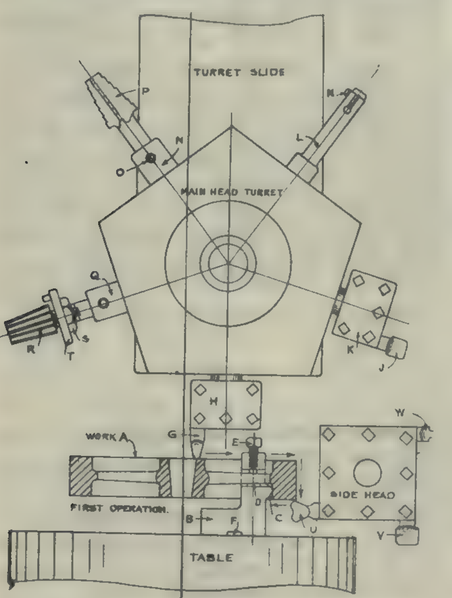


FIG. 1.

in a fraction of the time he formerly required, and is enabled to carry loads which would have been prohibitive with horse-drawn vehicles. He also uses tractors for his plowing, reaping, harvesting, etc., and a stationary engine for pumping water, cutting wood, threshing grain and many other purposes.

In nearly all of the industries the gas engine has become a prominent factor, and its development has been such that it is now so perfected that it is very nearly "fool-proof," and requires little attention to keep it in running order, so that it can be successfully used by any-one having an ordinary degree of common sense. The flywheels used on these engines are of many kinds, but they all have one point in common, viz., a heavy rim which, by its momentum, assists in keeping the output uniform. This rim must run in concentricity with the axis of the wheel, and must be carefully balanced in order to prevent vibration when running at a high rate of speed.

As there are so many types of gas engines, it is evident that the flywheels also would be of different construction, according to the class of work for which they were intended. A flywheel for a cheap farm engine may be of one type and one designed for an automobile of another, while a flywheel for a motorcycle engine shows other variations in design. Spoked wheels having a heavy rim are employed in many instances on the cheaper variety of stationary engines, such as those used for pumping or other farm work and webbed wheels, with provision for some form of clutch on their interior or exterior surfaces, are found on automobile or boat engines. The clutch surfaces may be either straight or taper, but the latter is more commonly found.

In the machining of these various types, the smaller wheels are commonly handled on some one of the many kinds of horizontal turret lathes, while the larger sizes are more economically handled on the vertical turret lathe or vertical boring mill, these being of sufficient power to take very heavy cuts, and, being of vertical construction and massive design, are not subject to the vibration apparent in the smaller machines of the horizontal type. In addition to this feature, the chucking and holding of the work is somewhat simplified, as the piece is laid down on the table, instead of being, so to speak, hung on the end of a revolving spindle. We shall consider the machining and handling of three varieties of flywheels on the vertical type of turret lathe.

Machining a Spoked Type Farm Engine Flywheel.

The work A shown in Figure 1 is a farm engine flywheel of the spoked type which is to be machined in two settings, the first of which is shown in the illustration, with a tooling diagram which shows the tools required for the work and their position and sequence of operations.

The method of holding the work is somewhat out of the ordinary, in that a set of special jaws B is used, which centre the work from the inside of the rim by means of the offset C in the jaws. The jaws are keyed to the sub-jaws in the table at F, and are provided with a set of steel buttons or plugs D on which the spokes of the flywheel rest. A slot is provided large enough to give plenty of chance for variations in the casting, and the set screws E are brought down tightly on the spokes, so that they serve to eliminate vibration and also act as drivers. It is not necessary, therefore, to set the jaws up on the work as

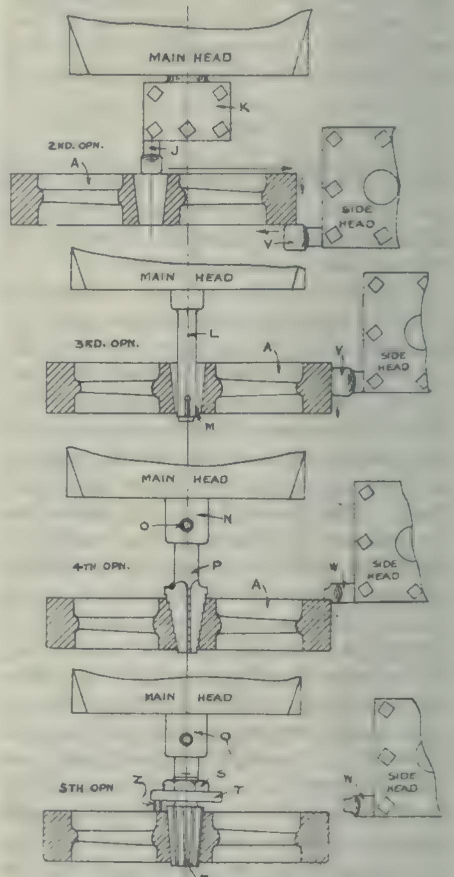


FIG. 2.

tightly as would otherwise be found advisable. With the exception of the reamers used for the tapered hole, the special tools required for this piece of work are of the forged variety, such as can be easily made up or bought ready for use.

Operation Features.

The first operation on the work consists of facing the hub and upper surface of the rim with the tool G in the standard tool holder H of the main head turret. It will be noted that the projecting heads of the set screws E make it necessary to stop the machine when pass-

ing from the hub to the rim, or else raise the main head, and drop down again after traversing the head to the required point. It is preferable to stop the machine for a moment so as to avoid variations in the heights of the two surfaces which might be caused by errors in re-setting the main head turret. While the main head is working on the hub and rim, the side head is brought up and the tool U is started on the undercutting of the rim. It will be noted that this tool is so made that it will cut on the face or on either side, so that after the undercutting has been completed it is withdrawn and started on the outside turning as indicated by the arrow.

Referring to Figure 2, the remainder of the operations necessary to complete the piece will be found in sequence. The second operation is accomplished by the finishing tool J in the main head, being supported by the standard tool holder K, and during its operation the side head tool V continues the outside finishing and undercutting.

Before the outside face has been completed, the main head turret is indexed until the boring bar L is in position and the tool M is used to true the hole in preparation for the taper tools which follow. This truing operation is important, for there are apt to be variations in the cored hole which would produce an eccentricity if taper tools were used on the rough surface on account of their tendency to follow the hole. If, however, the hole is correctly generated a short distance with a single point boring tool, the subsequent tools will naturally follow the true hole, so that the work will be concentric when completed. While this truing is in progress, the outside has been completed by the side head tool V.

The fourth operation consists of roughing out the tapered hole with the roughing taper reamer P, the cutting edges of which are serrated to form a series of steps so that the chip is well broken up and the cutting action made easy. This reamer is of the floating type, and is secured in the holder N in the main head turret, the pin O acting as a driver. The shank of the reamer is a few thousandths smaller than the hole in the holder, and the hole through which the driving pin protrudes is somewhat larger than the pin so that a good floating action is assured.

The fifth operation is that of finish reaming the tapered hole, and between this and the previous operation, the tool W in the side head is utilized to slightly round the corners of the rim. The reamer R in this instance has straight flutes because the taper is a fairly blunt angle, so that there is very little danger of "drawing in." The spacing of the teeth may be unequal if desired in order to obviate any possibility of "chatter." If it were required to machine the hole to a very acute taper, it would be advisable to make the reamer with a left-hand spiral in order to prevent any tendency to "draw in." The spiral in a case of this kind should be from five to eight degrees. The shank of the reamer floats in the holder Q, and is provided with an adjustable collar T, having three pins which act as stops against the hub, so that the correct diameter of the hole may be easily maintained. The check nut S secures the collar in its determined position. This operation of reaming completes the first setting of the work.

Several points in the tool layout are worthy of comment: The construction of the jaws; the fact that replacements of the forged tools can be readily made, and the three-point contact of the reamer stop. The latter feature is important, in that any dirt or chips which may be lying on the top of the hub do not interfere with the action of the stop, as might be the case if a plain-faced collar were used.

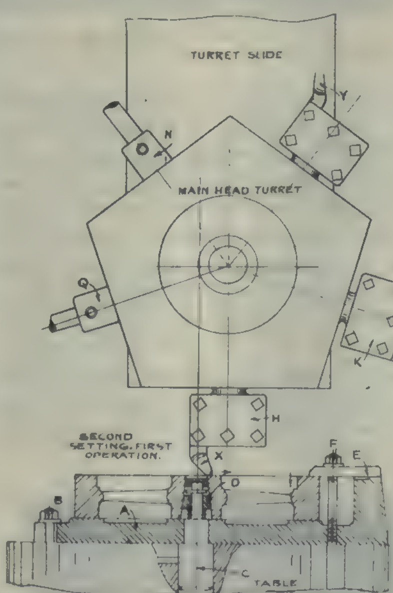


FIG. 3.

Second Setting of the Flywheel.

A peculiar condition obtains in the second setting of the work, because it is necessary to locate from the tapered hole and also to use the rim surface to rest the work upon. Now it would obviously be out of the question to locate the piece on a fixed tapered plug and on the faces of hub and rim at the same time, because there might be slight variations at these points which would cause the work to run "out of truth." A reference to the illustration, Fig. 3, will show the manner of providing for this variation and compensating for slight inequalities.

The work is placed on the fixture A so that the previously faced rim lies flat on the annular pad, the central location being obtained by the floating taper shell D, which is forced up into the hole by the coil spring beneath it, and is restrained from an excess of movement by the pin shown in the illustration. It will be readily seen that this method of locating compensates for slight variations between the tapered hole and the finished surfaces of rim and hub. The plug C which centres the fixture on the table is used as a guide for the tapered shell, locating bushing and the fixture itself is held down on the table by means of the bolts B which enter the table tee-slots. Three clamps E are arranged around the fixture and serve to clamp the rim of the flywheel down upon the annular pad. The studs F are used in place of a cap screw, so that the wear on the thread is not taken by the cast iron, but by the steel thread on the stud and nut. This method of construction is much to be preferred to a cap screw or bolt, which is tapped into the cast iron base of the fixture and the life of the thread is prolonged by its use.

Very little change is necessary in the tools for this setting. The roughing tool G in the holder H is replaced by the bent tool X, which is used to face the end of the hub and rough bore the inner surface of the rim which is indicated by the arrow. The boring bar L used in the first setting is replaced by another tool holder of standard make, in which is placed the finishing tool Y, which finish faces the hub and finish bores the inside surface of the rim. All the other tools in the main head turret remain as they were in the first setting of the work, and it will furthermore be noted that as the side head is not used at all in this second setting, it is, of course, unnecessary to disturb these tools, the side head being simply drawn back out of the way during this setting.

INTERESTING CUPOLA INSTALLATION.

IN the November issue of the Journal of the American Science of Naval Engineers, a description is given of a foundry cupola of 600 lb. capacity, installed at the Puget Sound navy yard. It was constructed to avoid the great waste that followed the use of a 6,000 lb. cupola when only a few small castings were required, and was made largely from scrap material. It is only about 4 ft. high from the base, and the internal diameter inside the lining is 14 in. The tuyeres, two in number, are rectangular in shape and expanding, with their lower edges 10 in. from the bottom. The opening is 6½ in. wide at the broad end and about 5 in. at the narrow end, by 4 in. deep, and the ratio of cupola area to tuyere area is

approximately three to one. The bottom plate is a casting incorporating the spout, while the cylinder is made of steel plate. The blast is taken from the compressed air system of the yard. It induces air in a three-stage injector and delivers it to the cupola about fifteen times its own volume. The cupola is hinged at the front to the base so that it may be turned on its side for repairs and relining. It has proved entirely satisfactory.

BASCULE BRIDGE AT SAULT STE. MARIE.

WHAT is claimed to be the longest bascule bridge in the world, crossing the United States ship canal at Sault Ste. Marie, Mich., has now been in successful operation for several months, and, aside from its record size, it presents many interesting and novel points in design. It is 355 feet in length between centres of front piers, or 336 feet from trunnion to trunnion, and has two folding leaves, which, as shown in Fig. 1, interlock in such a manner as to form a single rigid span from pier to pier.

The Sault Ste. Marie Bridge has its leaves of the Strauss heel-trunnion type, each leaf being formed of two riveted trusses, 168 feet in length and 55 feet deep, spaced 20 feet apart on the centres. They carry a single track for the Canadian Pacific Railway, forming a portion of the International Bridge across the St. Mary's River. The leaves are counterbalanced by heavy, overhead masses of concrete, which are suspended from counterweight trusses connected to the bascule trusses by parallel links. Each leaf with its mechanism is carried on a tower, the trunnion being located at the base of the framing carrying the bearing for the counterweight and counterweight mechanism.

The specially interesting feature of the new bridge is the arrangement made for allowing for expansion and contraction at one end of the span. This is accomplished by placing one entire tower with its leaf and counterweight on rollers, so that this end of the span is free to move when the bridge is closed, but when the open mechanism is in operation the tower may be held stationary. When the bridge is lowered, the bottom chords unite somewhat in the same fashion of an ordinary car coupling at a tension hinge, which can be locked so that the two leaves are joined together, and under a live load act as a single span from pier to pier. The bridge is operated from one operator's house by electricity, and may be opened and closed in $1\frac{1}{4}$ minutes. A hydraulic control with an oil pump enables the operator to adjust the position of the tower according to temperature.

FIG. 1. BASCULE BRIDGE AT SAULT STE. MARIE.

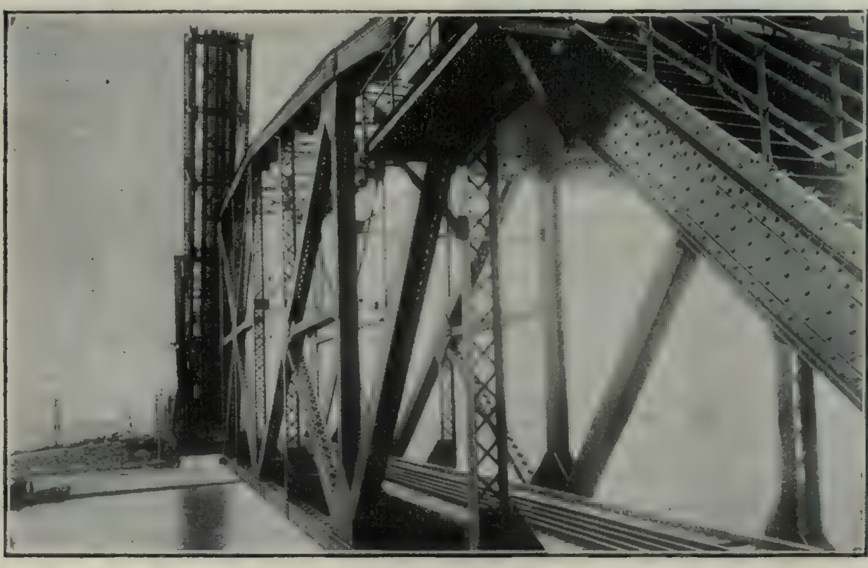


FIG. 2. BASCULE BRIDGE AT SAULT STE. MARIE. DETAIL FEATURES.

When it is realized that the superstructure is 426 feet long over all, including towers, the amount of contraction and expansion which must be allowed for can be readily appreciated. The entire structure contains about 1,400 tons of structural steel, and each bascule leaf with its floor system weighs about 400 tons. Although the bascule bridge has long ceased to be a novelty, yet the features incorporated in the present structure are so unique as to have aroused considerable attention. The system of top and bottom chord locks at the centre of the span provide for compression, tension and shear, and have been so carefully arranged that a strong and homogeneous structure has been secured.

STRENGTH OF COPPER AT HIGH TEMPERATURES.

THE strength of copper at high temperatures was the subject of a paper by Dr. G. D. Bengough and D. Hanson at the September meeting of the Institute of Metals at Portsmouth, England. The results of investigation showed that the nature of the atmosphere was an important factor, an oxidizing one at a high temperature giving a high degree of ductility to copper.

In a neutral atmosphere, pure unannealed rolled copper retains all its superior strength over annealed copper at all temperatures from 20 to 1,000 deg. C. With pure annealed copper, fracture takes place through all crystals at all temperatures below 700 deg. C., while above 750 deg. C. it passes between the crystals with either possible course at intermediate temperatures. A range of low ductility was discovered at temperatures about 250 to 450 deg. C. While small amounts of oxygen and arsenic decrease the tensile strength at high temperatures, increased ductility was observed. In hydrogen above 720 deg. C. the tensile strength was about a half ton per square inch lower than in a neutral or oxidizing atmosphere.

As a whole the results of the tensile tests are consistent with the theory that the crystals of copper are enveloped in a cement which at low temperatures is stronger than the crystals themselves.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

PIPING.

PIPING a steam or hot water heating plant may apear to be a very simple operation. The number of leaks which usually develop, particularly in the hot water heating systems of high buildings shows that there is much room for improvement in the care given to the thread cutting and pipe fitting in connection with this work. The carelessness of the average plumber for appearance is proverbial. This is more or less surprising when the small amount of thought and effort required to make horizontal pipes horizontal, vertical pipes vertical and to simplify the systems generally is taken into account.

The use of oakum or rope-yarn to make joints tight is to be condemned. At best it serves but to cover up a possible poor job and is thus a direct reflection upon the quality of the workmanship. There is nothing better than a metal-to-metal joint for any purpose.

The lengths of pipe required can be easily determined. The fitting is measured from its face to its centre, and the amount the pipe is required to enter the fitting is subtracted from this distance. The difference thus found is subtracted from the length of the pipe for each threaded end measured from centre to centre of fittings.

In piping for steam a number of simple rules are in use which greatly simplify the obtaining of dimensions. Most of these are based upon the fact that the maximum speed of steam flow in pipes is 6,000 feet per minute and is, in some cases kept down to 5,000 feet per minute. It is equally undesirable to make steam pipes too large as to make them too small, as the weight, cost of covering and radiation loss is greatly increased. For water piping the frictional resistance of the pipe to the flow of the water is the main consideration. This depends upon the diameter of the pipe, the number of bends or obstructions and the condition of the internal surface. The effect of bends and fittings is reduced by simple rules to a length of pipe which would provide the same resistance.

Steam and water pipes are rated by their inside diameters. The actual inside diameter of standard pipe, however, is always a little larger than the rated size. The rating of tubes, on the other hand, is based upon the external diameter and they are usually fairly accurate to this size. Any increase in the thickness of the tube requires a corresponding decrease in the inside diameter.

Question.—What sized steam-pipe should be provided for an engine with a 30-inch cylinder, a 36-inch stroke, and which runs at 90 r.p.m.?

Answer.—For a steam flow of 6,000 feet per minute the diameter of steam-pipe must be:

$$\frac{\text{cross-sectional area of Cylinder} \times \text{piston speed in feet per minute}}{6000}$$

$$\frac{30 \times 30 \times .7854 \times 36 \times 2 \times 90}{6000 \times 12} = 63.617 \text{ sq.in.}$$

Doameter of pipe having area of 63.617

$$\text{sq. in} = \sqrt{\frac{63.617}{.7854}} = 9 \text{ inches.}$$

Question.—What horse-power engine could be served by a 9-inch steam-pipe?

Answer.—Multiply the square of the diameter by 6, or $9 \times 9 \times 6 = 486$ horse-power.

* * *

Question.—What amount of heat radiating surface would be provided by a coil composed of 370 feet of $1\frac{1}{4}$-inch pipe?

Answer.—Outside diameter of $1\frac{1}{4}$-inch pipe is 1.66 inches. Surface area =

$$\frac{\text{diameter in inches} \times 3.1416 \times \text{length in in.}}{144}$$

$$= \frac{1.66 \times 3.1416 \times 370 \times 12}{144} = 160.797 \text{ sq. ft.}$$

* * *

Question—What quantity of steam per minute would flow through a 3-inch pipe, 80 feet long, under a boiler pressure of 90 pounds and a discharge pressure of 50 pounds per square inch?

Answer.—Divide 3.6 by the diameter in inches; add one to the quotient and multiply by the length of the pipe in feet. (1)

or $\frac{3.6}{3} = 1.2$; $1.2 + 1 = 2.2$; $2.2 \times 80 = 176$ (1).

Multiply difference between boiler and discharge pressures by the fifth power of the diameter and by the density at the boiler pressure. (2). Or $90 - 50 = 40$; $40 \times 243 \times 258 = 250.7760$ (2).

Divide (2) by (1) and multiply the square root of the quotient by 87.

$$\text{or} \frac{2507760}{176} = 1428; \quad \sqrt{14248} = 119.3$$

$$119.3 \times 87 = 10379 \text{ pounds.}$$

Question.—A flange pipe joint of 3-inch pipe is subjected to a hydraulic pressure of 400 pounds per square inch. If the joint is packed with a sheet of leather $\frac{1}{8}$ inch thick, and the flanges are smooth, what will have to be the pressure between the flanges to keep the packing in place?

Answer—The total pressure on the packing is

$$\frac{3 \times 3.1416 \times 400}{8} = 471.24$$

pounds.

The coefficient of friction for leather on cast iron is .56. As friction acts on both sides of the packing, this becomes $.56 \times 2 = 1.12$, or the friction = 112 per cent. of the load. The force with which the bolts should be screwed up is

$$\frac{471.24}{112} \times 100 = 420.75 \text{ pounds.}$$

* * *

Question.—What quantity of air could be delivered by a 2-inch pipe 100 feet long? Supply pressure is 90 pounds and discharge pressure is 86 pounds per square inch.

Answer.—Formula, $V = 58 \sqrt{\frac{pd^5}{WL}}$

where.

p = difference in pressure at two ends of the pipe.

d = inside diameter of pipe.

L = length of pipe in feet.

W = weight in pounds of 1 cubic foot of entering air.

V = volume of air in cubic feet per minute, or volume $= 58 \sqrt{\frac{4 \times 37.6}{.08073 \times 100}}$ $= 58 \sqrt{18.63} = 58 \times 4.32 = 250.5$ cubic feet per minute.

Question.—Find the thickness of a cast iron pipe 6 inches inside diameter for a steam pressure of 200 pounds per square inch.

Answer.—By approximate rule,

$$\frac{\text{diameter in inches} \times \text{pressure in pounds}}{2,700}$$

$$= \frac{6 \times 200}{2700} = .444 \text{ inch.}$$

By exact calculation, projected pressure on section of pipe 1 inch long $= 6 \times 200 = 1200$ pounds. Part sustained by 1 thickness of pipe $= \frac{1200}{2} = 600$ pounds. Strength of cast iron in tension = 15,000 pounds per square inch

which, with a safety factor of 10 becomes 1500. Thickness of pipe required then is $\frac{600}{1500} = .4$ inch. So that the approximate rule gives a safety factor of about 10. For wrought iron use 4500 instead of 2700.

* * *

Question.—What quantity of water would be discharged by a straight $1\frac{1}{4}$ inch pipe 100 feet long under 50 pounds pressure per hour?

Answer.—Formula, velocity $= C\sqrt{\frac{hD}{L+54D}}$

where

C is a coefficient depending on size of pipe.

D is pipe diameter in feet $= 0.104$.

h is total head in feet.

L = length of pipe in feet.

Head in feet $= 2.309 \times 50 = 115.45$

or velocity $C\sqrt{\frac{115.45\times.104}{100+5.616}} = 24\sqrt{.113676}$

$= 24 \times .3371 = 8.09$ feet per second.

Discharge in cubic feet per second = velocity in feet per second $\times$ cross-sectional area of pipe in square feet. or discharge $= \frac{8.09\times1.2272}{12\times12}$. Discharge in cubic feet per hour

$= \frac{8.09\times1.2272\times60\times60}{12\times12}$, or in gallons per hour $= \frac{8.09\times1.2272\times60\times60\times6.16}{12\times12}$

$= 1527.67$ gallons per hour.

* * *

Question.—What would be the loss of heat per hour from a steam pipe 60 feet long 4 inches in diameter carrying steam at 140 pounds gauge pressure in a building where the average temperature is 60 degrees F.

Answer.—A bare pipe loses heat at the rate of 2.7 B.t.u. per hour per square foot of pipe surface for every degree difference between the temperature of the pipe and that of the surrounding air.

The temperature of steam at 140 pounds is 360 degrees.

Difference of temperature is 360 —60 = 300 degrees.

Surface area of 60 feet of 4-inch pipe is $\frac{4.5\times3.1416\times60}{12} = 70.68$ sq. ft.

Heat radiation is $70.68 \times 2.7 \times 300 = 57{,}250$ B.t.u. or is the equivalent, with an average boiler, of $\frac{57250}{8400} \times 24$

$= 163.6$ pounds of coal per day.

UNIVERSITY OF TORONTO AND THE EUROPEAN WAR.

THOUGH the military organizations of the Canadian colleges were in a much more rudimentary condition than those of the British Universities, a large contribution has already been made to the army for the present war from their graduates and undergraduates. The following is an account of what has been done by the University of Toronto:

First Contingent.

Officers—Lt.-Col. C. H. Mitchell, B.A.Sc., member of the Board of Governors; Lt.-Col. R. D. Rudolf, Professor of Therapeutics; Lt. Col. W. A. Scott, Associate in Surgery; Major P. Goldsmith, Demonstrator in Oto-Laryngology; Captain G. R. Philp, Demonstrator in Anatomy; Captain P. K. Menzies, Assistant in Clinical Surgery; Captain G. A. Cline, Instructor in University Schools; Captain C. E. Cole, Demonstrator in Therapeutics; Dr. B. E. Clutterbuck, Assistant in Gynaecology; Dr. A. J. Mackenzie, Demonstrator in Medicine, and Mr. E. Owen, Lecturer in German.

According to most recent information there are, besides the members of the staff, 134 graduates and 86 undergraduates, and of these 137 are officers and 83 privates. The chief electrician and several of the laboratory assistants are also on service, and their places are being kept for them. Professor de Champ, and Messrs. Balbaud and Bibet of the Department of French in University College have been serving with the French Army since the beginning of the war.

Second Contingent.

Officers—Lt.-Col. Fotheringham, Associate-Profesor of Clinical Medicine, is Chief Medical Officer. Other members of the staff who have been giving their time in preparing for its mobilization are: Captain J. A. Amyot, Professor of Hygiene; Lt.-Col. J. A. Roberts, Demonstrator in Clinical Surgery; Lt. G. B. Strathy, Demonstrator in Clinical Medicine; Lieut. Bruce Robertson, Assistant in Pathology.

At present our information is quite incomplete, but we understand that 53 graduates and 63 undergraduates have been accepted.

At the opening of the present session the Caput, Senate and the Faculty Councils passed regulations to provide that standing should be granted to those who by reason of enlisting had been unable to take their September supplementals; also, that those who had enlisted or who would do so, should be shown the utmost consideration at the end of the session that the University's duty to the public in maintaining professional standards will allow. It was further decided to discontinue all teaching and laboratory work after four o'clock in the afternoon in order to enable students to takes the courses of drill and instruction required by the regulations of the Officers' Training Corps.

Officers' Training Corps.

In view of the probable establishment of an Officers' Training Corps in the University, a score of junior members of the staff began about September 15 to take drill and instruction to qualify themselves to become officers in the new corps. About October 20, authorization was received from the Militia Department. Dr. W. R. Lang, Professor of Chemistry, who with the concurrence of the Board of Governors had volunteered for active service but was appointed Instructor for this Military Division, was made Colonel of the new corps. Messrs. C. S. McVicar, A. D. Le Pan, G. N. Bramfitt, C. H. C. Wright, R. H. Hopkins, G. H. Needler, F. C. A. Jeanneret, L. Gilchrist, M. W. Wallace, G. O. Smith, C. N. Cochrane, C. V. Massey, G. M. Smith, E. J. Kylie, G. S. Brett, E. S. Ryerson, A. F. Coventry, G. Gallie, W. F. McPhedran, R. G. Armour, D. Graham, C. R. Young, D. G. Hagarty, A. M. Thomas, A. W. McConnell, W. M. Treadgold, B. M. Morris, H. H. Madill, J. R. Cockburn, J. R. Mitchener, V. E. Henderson, H. R. Hopkins, A. R. Leggo, W. S. Wallace, H. G. Manning, all except three being members of the staff, have been appointed officers. The students enrolled enthusiastically, and though the strength authorized as yet is only 1,000, over 1,800 have been taking drill.

On Friday, January 22, 1,500 students with their officers were reviewed by His Royal Highness the Duke of Connaught. He addressed them in part as follows: "I wish to express to you my very great satisfaction with the splendid turnout you have given me this evening. When I looked at you and saw how you stood to attention and the admirable way in which you marched past, I saw that your work since you were formed, a very few months ago, has been performed with a will, and I can honestly say that I have never seen better results than you have shown me to-day. What pleases me still more is the splendid example you young gentlemen are showing to the whole of Canada. You have come forward at a moment when every man that is able to do anything to help the Empire in a time of stress is needed, and you have done so readily and in a most efficient manner.

The Women Students.

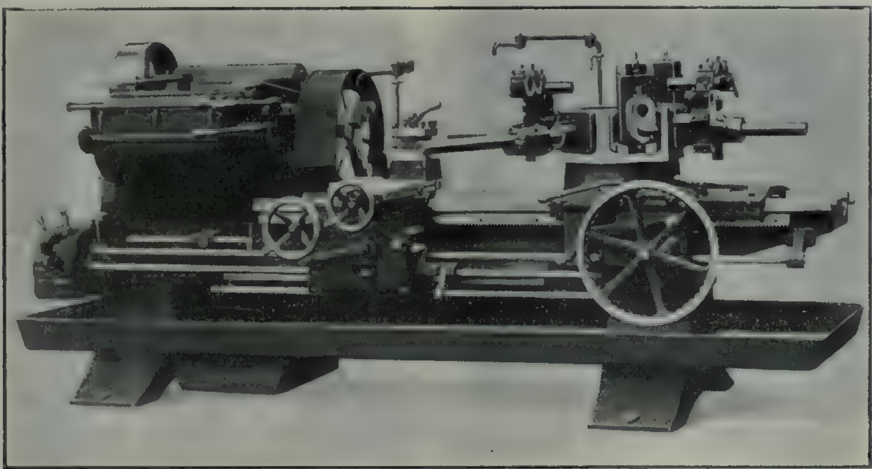
The women students of the University have also shown their determination to be of service by occupying the hours from four to six in the afternoon, when there is no instruction given in the University, with sewing and other work for the Red Cross Society.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

UNIVERSAL HOLLOW-HEXAGON TURRET LATHE.

THE latest product of the Warner & Swasey Co., Cleveland, Ohio, is an improved model of the Universal Hollow-Hexagon Turret Lathe, the improvements applying to both the 2-A and 3-A machines; but as the 3-A was the first to be completed, the description will be confined to that machine.

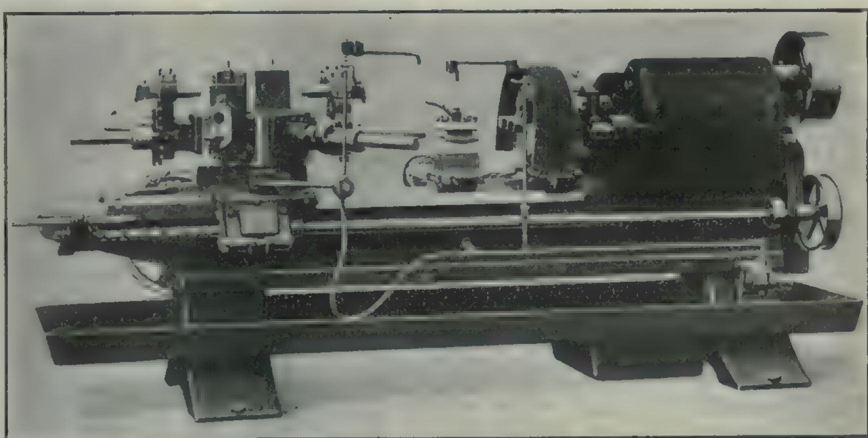


UNIVERSAL HOLLOW-HEXAGON TURRET LATHE, FRONT VIEW WITH CHUCKING EQUIPMENT.

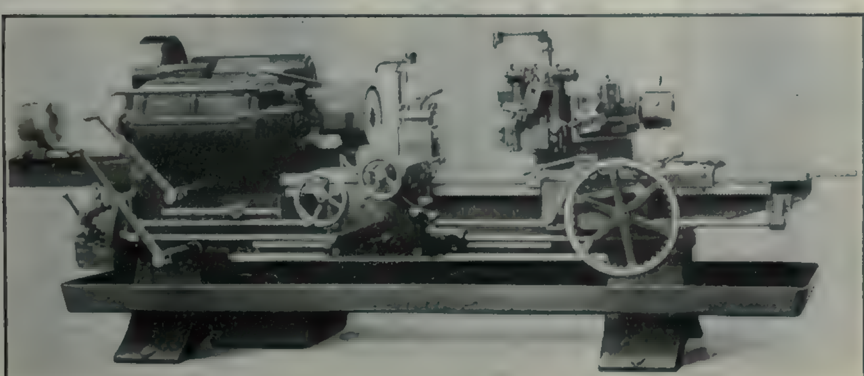
The most noticeable change is in the design of head. The former head has been superseded by one entirely new in type, and with gears running in oil. Not so apparent, but perhaps of greater importance, are the increased working range, the greatly increased power of the head, the corresponding increase in the rigidity and strength of the bed and the two carrying units, as well as the larger and more rigid tools. These changes have resulted in greatly increased capacity and efficiency of the machine.

The greater capacity has been attained without noticeably increasing the size and operating dimensions of the machine; in fact, the new model is more compact than the former one. The automatic chuck of the No. 3-A machine now takes round stock up to 3½ inches, and the length turned has been increased to approximately 40 inches. The swing over the cross slide carriage has been increased to 17¼ inches, and the maximum swing of the machine to 21½ inches. The capacity of the No 2-A machine has been correspondingly increased.

Although the earlier model was a most powerful machine, the new unit has power and rigidity greatly in excess of requirements. The new geared head, with the 5-inch belt running on the 16-inch diameter pulley, is capable of delivering 14 horse-power, with a large overload factor, this amount of power being required only when machining heavy steel castings or forgings and making several cuts simultaneously. The rigidity and strength of the bed, the two-tool carrying units and the feeding mechanisms for same are well in proportion to the power delivered by the head to the work. The tools are re-designed in keeping with the increased capacity, and are of more rigid construction. The splash system of continuous lubrication employed in the head, with the gears running in oil, insures a steady stream of lubricant. This reduces to a minimum the fractional loss of power in the head, and affects at the same time a very decided increase in the life of the machine.



UNIVERSAL HOLLOW-HEXAGON TURRET LATHE, REAR VIEW WITH CHUCKING EQUIPMENT.



UNIVERSAL HOLLOW-HEXAGON TURRET LATHE WITH BAR EQUIPMENT.

The pan has been placed lower to give increased space for chips, and to assure easy accessibility to those parts of the machine directly over it. The legs have been re-designed in semi-box type and with a very wide spread, to assure a solid support and freedom from vibration, while the turnstile operating the turret saddle has been superseded by a large hand wheel. The turret and carriage are power operated simultaneously, with the feeds independent of each other. By this means two distinct operations can be made at the same time—as for example, boring with the turret while the carriage is facing or recessing

and cutting off. As many as eleven tools may be placed in operation with one set-up. Through a variety of combinations, feeds ranging from 10 to 218 are produced. The machine has twelve spindle speeds, both forward and reverse, with ten feed changes in each direction for both carriage and turret. The feed changes are controlled by the feed box at the head end of the machine. The spindle speeds range in geometrical progression from 8 to 250.

MAIN TURBINE AND GENERATOR UNIT, WITH OLD UNIT AT LEFT REAR AND EXCITER UNIT AT RIGHT.

As in the earlier type, the head is cast solid with the bed to assure maximum strength and rigidity. It is of the single-pulley type, and may be belted directly to the line shaft or to a constant speed motor. Taper turning and screw chasing attachments are furnished when desired. The taper attachment turns tapers up to 1½ inches to the foot, in lengths of 15 inches, while the screw chasing attachment cuts from 2 to 48 threads any pitch. Each leader will cut 3 pitches that are multiples of 1, 2 and 4 of its own thread.

Notwithstanding the great power and range of the machine, every facility has been provided to make it easy and quick of operation. The power rapid traverse of the turret saddle facilitates this. The independent adjustable stops for both the turret saddle and the carriage reduce setting-up time to the minimum, and the hollow hexagon turret permits tools to be bolted from the inside, assuring maximum use of each face of the turret, with full support for the tool in the direct line of thrust and torsional strains. In short, the adaptability is such that in actual practice this machine has been found economical where but a few pieces of a kind are to be finished—frequently as few as six pieces—as well as for specialized manufacturing work. These features, together with great power, rigidity, and accuracy, contribute to render the machine most highly efficient. Being equally adaptable to bar and chucking work, and with standard tools suitable for a large range of everyday needs, it will also be found most economical for a great variety of work.

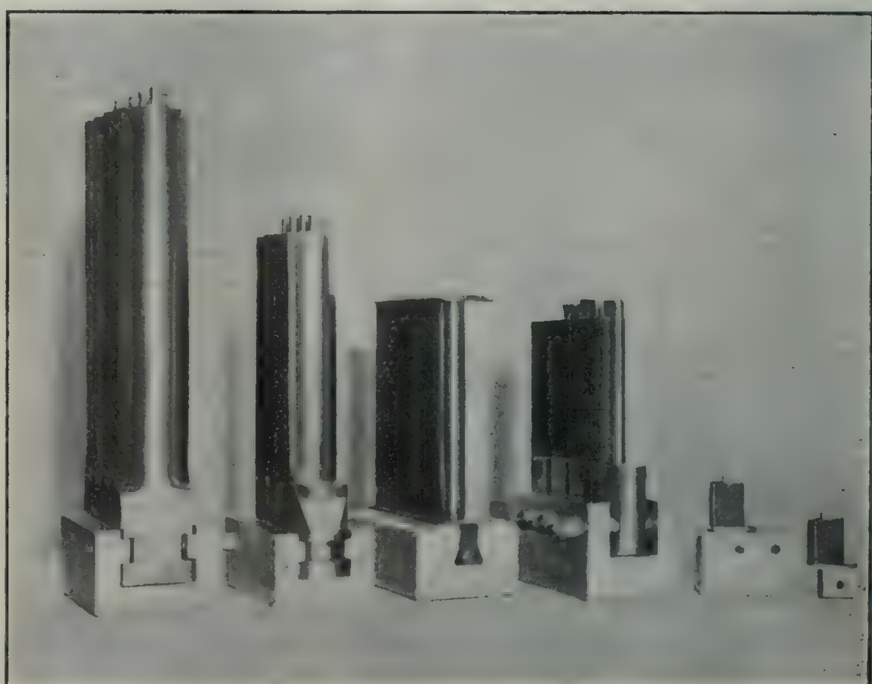
NEW TURBINE EQUIPMENT, MONTREAL TRAMWAYS CO.

A NEW Belliss & Morcom steam turbine has recently been installed and put into operation at the Hochelaga Power House of the Montreal Tramways, and is an important addition to the already installed turbine equipments in Canada.

The Belliss turbines have many novel points in design, which will be mentioned later, perhaps the most outstanding feature being the moderate speeds at which they run. Although for long the foremost exponents of quick revolution engine manufacture, their practice from the first has been to advocate moderate speeds in turbines, and only in very exceptional circumstances when the conditions are specially favorable are they willing to offer speeds exceeding 1,800 r.p.m. on high pressure turbines above 1,000 kilowatts.

There is little doubt that the factor of safety of the moving parts of large turbines running at speeds of 3,000 to 3,600 r.p.m. is extremely small, and exists irrespective of the design, and many of the serious acidents that have occurred must be attributed to this cause. When it is realized that a 5-ounce blade at these higher speeds may readily develop a force of 2,000 lbs. due to centrifugal action, the difficulty of design becomes apparent. It cannot, on the other hand, be disputed that the slow-running turbine has a more conservative factor of safety, and is, therefore, a quieter and more reliable machine.

The unit installed by the Montreal Tramway Co. will be used to carry peak loads, also as a standby, and consists of a 2,000 k.w. turbine running at 1,800 r.p.m., connected to a Swedish General Electric Co. alternator. The turbine is designed to operate with 200 lb. steam pressure of a temperature of 570 degrees Fah., and for a twenty-four-hour 25 per cent. overload, as well as a 50 per cent. overload for a period of two



STANDARD METHODS OF ATTACHING BLADES.

hours. Under full load conditions, the steam consumption guaranteed is 9.8 lb. per b.h.p. when exhausting into a vacuum of 28 inches.

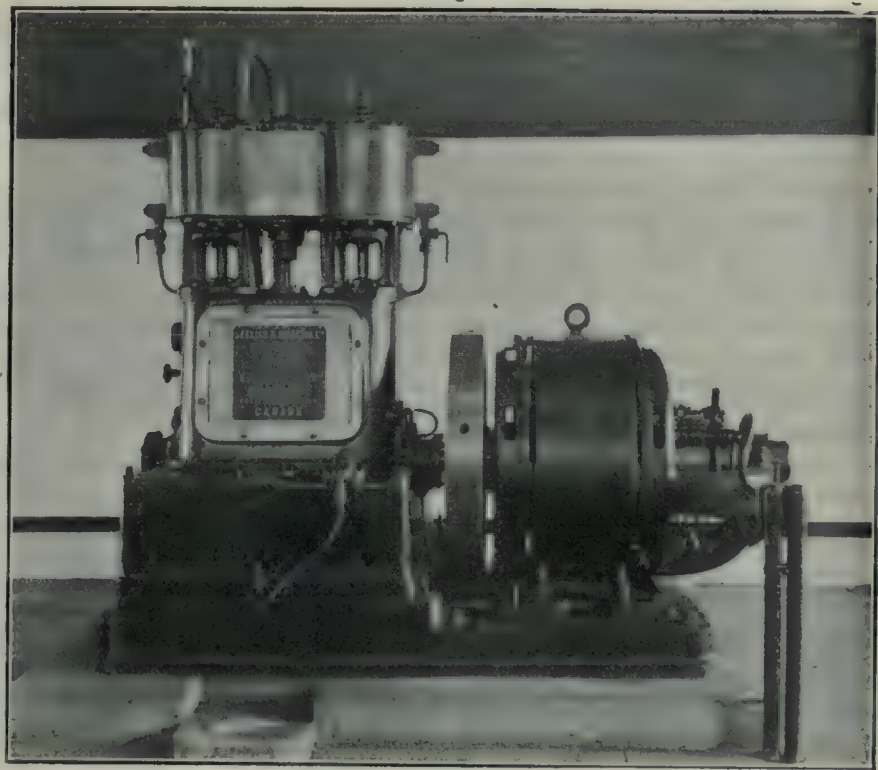
Turbine Constructional Features.

The blading is wholly impulse, and consequently there are no close clearances between the moving and fixed blades; thus precluding the possibility of these fouling. The first stage of the turbine is disc built and carries two rows of Curtis steel blading, compounded for velocity. The remainder of the turbine is drum built, with a series of phosphor bronze blading compounded for pressure. The drum is of forged steel with a through running shaft which ensures permanent alignment and a rotor very free from whip. The moving blades are attached to the disc and drum by a patented dovetail device which gives absolute rigidity, at the same time allowing individual blades to be readily replaced.

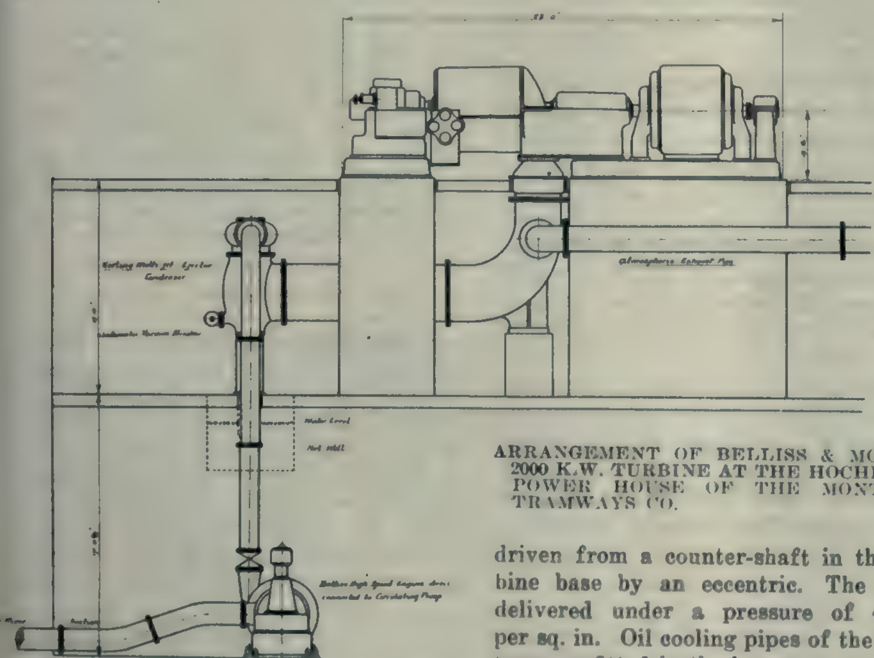
The critical speed of the rotor on account of its great strength and low velocity is far in excess of the normal working speed, and is never attained under ordinary conditons. The nozzles or fixed blades are attached to steel diaphragm plates and are of segmental construction. A Mitchell thrust is fitted, and the blocks are readily renewable. A Hoffman ball thrust is also provided as an emergency, and by an ingenious arrangement does not come into operation unless the main thrust fails.

Governor Feature.

The main governor acts on the throttling principle and is of the centrifugal type similar to that fitted on the Belliss high speed engines. It is driven from the tail-shaft by a worm gear. An emergency governor, consisting of a radial hammer opposed by an adjustable spring, is also fitted. Both governors operate separate oil relay systems, the main relay being on the usual dog lever principle, and the emergency relay of a special type acting as a dash-pot to close at a predetermined speed or on the failure of the oil supply; it may also be readily tripped by hand.



EXCITER UNIT INDEPENDENTLY STEAM DRIVEN.



ARRANGEMENT OF BELLISS & MORCOM 2000 K.W. TURBINE AT THE HOCHELAGA POWER HOUSE OF THE MONTREAL TRAMWAYS CO.

The oil pump is of the double-acting valveless type running at 100 r.p.m., and driven from a counter-shaft in the turbine base by an eccentric. The oil is delivered under a pressure of 40 lb. per sq. in. Oil cooling pipes of the Royle type are fitted in the base.

The turbine is connected to the alternator through a flexible coupling which runs under forced lubrication and ensures perfect alignment, and the whole of the turbine gear is completely enclosed, all moving parts being subjected to forced lubrication. The thrust and governor gear are readily accessible through large inspection doors conveniently arranged in the casing.

Accessory Equipment.

The exciter consists of a Belliss & Morcom vertical compound high-speed engine direct connected to a Swedish General Electric Co. generator having a normal output of 35 k.w. at 575 r.p.m.

A Korting multi-jet ejector condenser is situated directly beneath the turbine and is capable of maintaining a vacuum of 28½ inches under full load conditions.

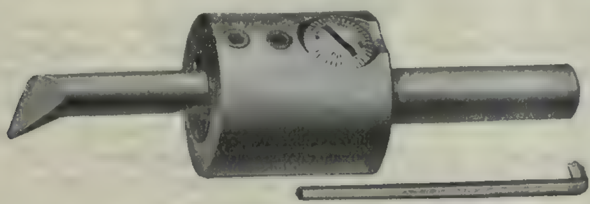
A centrifugal circulating pump is provided in the basement direct connected to a Belliss & Morcom vertical compound engine running at 475 r.p.m., drawing water from the river adjoining, and delivering it to the condenser under a pressure of 10 lb. per sq. in.

The turbine under all conditions of load is exceptionally free from vibrations and is an excellent example of high-class design and workmanship. A similar unit was installed for the city of Calgary, Alta., some twelve months ago, and a 750 k.w. mixed pressure turbine is now being erected for the International Coal & Coke Co. at Coleman, Alta.

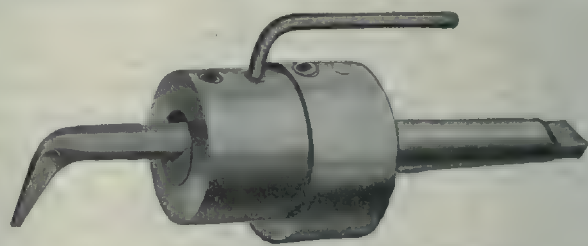
The whole installation was carried out by Laurie & Lamb, Montreal, the Canadian agents for Belliss & Morcom, of Birmingham, England.

NEW STYLE BORING HEADS.

TO meet the demand for boring heads smaller than their regular type, the Marvin & Casler Co., Canastota, N.Y., have brought out two new styles, to be known as models C and D. The construction of model C is practically the same as that of the line of large heads manufactured by the firm, but, in order to reduce the size to a minimum, the regular drill chuck used in the large size heads has been replaced by a hardened V block and set screws for holding the tools, Two set screws are used, ensuring a rigid grip of the tool. The V block is carefully aligned so that twist drills within the range of the chuck can be brought to run true by adjusting the offset through the micrometer screw. It is provided as in the larger sizes with a take up ring which keeps the moving parts in close contact. The V block grip enables the operator to use tools with round or octagon shanks of various sizes to meet requirements of the work; small size tools for small holes or larger size tool shanks for larger holes. The micrometer screw is graduated to read to .001. It makes a very desirable tool for small work, and with the shank as a part of the tool, it is ready to use when received.



NEW STYLE BORING HEAD—C.



NEW STYLE BORING HEAD—D.

The style D head consists of a shank and body, across which is moved a head or chuck which carries the boring tools. The offset adjustment is secured by two opposing hollow set screws threaded in the body, the inner ends resting against a cone shaped extension of the chuck. The adjusting screws are set at an angle to correspond with the cone shaped extension of the chuck, so that they act similar to a gib and draw the chuck firmly against the outer face of the body, and at the same time lock the chuck and tool in position for depth of cut. The tool is set for depth of cut by releasing one of the opposing set screws and following up with the opposite screw. The tools are rigidly held in a hardened V block by two hollow set screws, and either round or octagon tool shanks varying in diameter within the limits of the chuck can be used.

DON'TS FOR DROP FORGERS*

by W. L. Goodrich

DON'T put too much oil on the die during forging as it may check or burst.

Don't keep a die in a cold place after hardening, particularly if it has not been drawn properly.

Don't put a cold die block into a hot hardening or annealing furnace. Heat both up together.

Don't have any dark spots on the blocks when taken from the furnace. They should be the same color all over.

Don't use cyanide on the face in hardening die blocks, as it will cause the sharp corners of the block to break off.

Don't have the furnace too hot when heating the die blocks for hardening, as it is not the furnace that you want to harden, but the blocks.

Don't try to make the die do too much. Do as much breaking down as possible and allow the finishing dies to do as little as possible.

Don't draw a die block too fast after hardening; it is better to leave it on the hot plate or in the furnace one-half hour too long than not long enough.

Don't keep a die in the cooling water too long. Take it out as soon as the fingers can be held on the deepest part of the impression without burning them.

Don't put too much water on the shank of the die blocks. Only sufficient water should be put on the shanks during the cooling of the face to prevent distortion.

Don't break the corners on a die block by having them too hot. To aid in preventing breakage of corners of a die block during hardening, soap or oil the sharp corners before putting it in the water.

Don't allow the steal in forging to get too cold as it is very likely to crack the die, particularly where the impressions are deep and tapered. Excess material will also cause dies with deep impressions to crack.

Don't start up the hammers in cold weather without first preheating the dies; the dies may break if they are not heated before using. This accounts for the greater number of dies broken in cold weather than in warm weather.

Don't delay drawing the temper. As soon as the block has cooled so that the deepest impression will not burn the fingers, it should be immediately placed in a drawing furnace or drawn on a hot plate, shank down. This drawing should take place immediately after the block is taken out of the water.

Don't blame all the breakage of die blocks on the steel or the die block manufacturer. If a die block had a hole about one inch diameter drilled through the centre of it longitudinally, it would prevent the block from breaking, if the block should have a pipe. Drilling, of course, is only a precaution against piping.

Don't use still water for hardening a die block. The blocks should be immersed to a depth of about three inches in running water. This running water should have sufficient force to penetrate the steam film that forms when a piece of steel is cooling. By having a good flow of water and good force, soft spots will not appear in the working face of the block.

Don't allow the shoes in the hammers to get out of shape. One-sixty-fourth inch warpage in the shoe will very frequently break a die. shoes are frequently distorted, due to the fact that short dies are used for a certain length of time and then long dies are used on the same shoes, without dressing them. This will distort the shoes and break the die-blocks.

Don't heat a block fast. A rough and ready rule for the length of time a die block should be heated is one hour for each inch of thickness, plus one hour. In other words, a block eight inches thick should be heated about nine hours. It is better for the blocks to stay in the furnace an hour too long and thereby insure that they are heated throughout, than not to have them in the furnace long enough.

* From the "American Drop Forger."

Prompt Shipment Record.—A record for prompt shipment was recently made by the Whiting Foundry Equipment Co., Harvey, Ill., on an order for a three-motor electric traveling crane, 10 tons capacity, 30 ft. span. Telegraphic order was received at their plant January 23, calling for delivery of crane complete on purchaser's runway at New Bridge, Del., February 10, 1915. Drawings were made, crane constructed, and shipment made January 29, 1915. Crane reached New Bridge February 4th, and was erected complete ready for service February 6th, or four days ahead of schedule time.

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Vol. XIII. MARCH 4, 1915 No. 9

PRINCIPAL CONTENTS.

THE CANADIAN NICKEL QUESTION.

IN spite of the most emphatic official statements to the contrary, there is apparent a lingering suspicion both harbored and expressed that nickel products of our Dominion are finding their way into enemy hands, and, to the man in the street, the situation appears to become daily more perplexing. He believes himself to be the goat of either an "Ananias Club" officialdom or, through over-sensitiveness, the victim of a "Doubting Thomas" gang.

It is not in any sense reassuring, however, to find that the Ontario Government has decided to appoint a Nickel Commission to make an exhaustive investigation into the matter, nor is it any more so to realize that any report arising therefrom may not most probably be received until after the war is over. In any case, as generally happens, the patriotic feature will doubtless be sacrificed for that of party.

Numerous applications have, we understand, been received for the post of commissioners, of whom there will be three, but meantime one only has been decided upon as suitable, although his acceptance has not yet been indicated. There is difficulty it appears in getting men with the necessary qualifications, and this is not to be wondered at when we are officially told that the Commission will be expected to find some means of refining Ontario's nickel ore within the Province, and failing this, their appointment is supposed to constitute an opportunity to invent a means.

Money, as in every other feature of our complex existence, with a few rare exceptions, will refine Ontario's nickel ore within the provincial boundaries, just as it may also defeat that objective. Money will also enable Germany to procure our product and is doubtless doing so if the suspicions of the "Doubting Thomas" brigade prove to be well founded. We are giving of our manhood and substance for the cause of Empire and the rehabilitation of Belgium and France, yet there appears to be no absolute assurance that we are not also being made the medium to offset these gifts. Canada has been and still is being exploited by insiders as well as outsiders in almost endless, subtle and devious ways, and little surprise will be evidenced if sooner or later we awaken to the knowledge that the enemy got our nickel, our patriotism notwithstanding.

The hearts of our people are deeply stirred on this question of our nickel export destination, and their demand is that all quibbling on the one hand and cavilling on the other should cease. Britain's navy can be relied upon to prevent direct shipment to Germany, but not necessarily, through neutral countries, indirectly to her. Canadian statesmanship can, if it is worthy the name, make the latter contingency as impossible as the former; otherwise let that statesmanship take the bit between its teeth and admit its failure. The man on the street has more brains and more intelligence than he generally gets credit for, and in nineteen cases out of every twenty he not only has more, but uses them to more intelligent purpose than do his so-called leaders and administrators.

This nickel refining business has, we believe, more to it than any political-party-appointed-and-directed Commission will be able to unearth, however capable and conscientious its individual constituents. The principal producers of nickel from Canadian ore are the Mond Nickel Co., with its refineries in Wales, and the International Nickel Co., with its refineries in New Jersey, U.S.A. The former, as we might assume, is a British concern and the latter is American.

The nickel refining process has always been regarded as of a more or less secret nature, and reasonably so, because of the fact that most published matter relating thereto has been remarkable for its important detail feature omissions. Again, the cost of the process is reputed to be high, both from a material and labor point of view. Just then what Ontario's Nickel Commission will make out of their task—barring the pocketing of good fat salaries, is somewhat problematical. One thing is certain, however, a report will be presented, but we are not too sanguine that its achievement will amount to more than the distinction of being filed.

For the present or for the duration of the war, there is no real urgency for our embarking on a nickel refining enterprise, but there is real urgency in our people being absolutely assured that the product of our Canadian mines is being used as fully as requirements call for on our behalf, and that not an ounce of it is being used against us.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3.....	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	22 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 Plain..	22 00	19 00
Hamilton, No. 1.......	20 00	19 00
Hamilton, No. 2.......	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.10
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.10
Beams and angles, Pittsburgh ...	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 9 50	$10 00
Copper, crucible	10 50	11 00
Copper, unch-bled, heavy	10 50	11 00
Copper wide, unch-bled.	10 50	11 00
No. 1 machine compos'n	9 50	10 00
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	8 00	8 50
No. 1 brass turnings....	7 00	7 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	5 50	6 00

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Feb. 13, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal
Standard				
¼, ⅜ in.	64	49	....	....
½in.	69	58	....	....
¾ to 1½ in. ..	74	63	....	....
2 in.	74	63	70	59
2½ to 4 in. ..	74	63	73	62
4½, 5, 6 in. ..	....	....	72	62
7, 8, 10 in. ...	....	....	68	57
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in. ..	68	57	....	....
2, 2½, 3 in. ..	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in. ..	....	....	67	57
4½, 5, 6 in. ..	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2in.	44	34	....	....
2½ to 4 in. ..	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	43	....	....
½ in.	63	52	....	....
¾ to 1½ in. ..	68	57	....	....
2 in.	68	57	64	53
2½, 3 in.	68	57	67	57
3½, 4 in.	....	....	67	57
4½, 5, 6 in. ..	....	....	65	55
7, 8 in.	....	....	61	50

Wrought Nipples	
4 in. and under	72½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in. ..	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in. ..	70%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake Copper, carload ..	$16 50	$16 50
Electralytic copper	16 25	16 25
Castings copper	16 00	16 00
Tin	44 00	44 00
Spelter	11 00	11 25
Lead	5 15	5 75
Antimony	20 00	20 50
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$20 00
Openhearth billets, Pittsburgh.	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh..........	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 20
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16...........	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes ..4¼c per lb. off	
Nuts, Hexagon, all sizes.4¾c per lb. off	
Iron rivets .... 72½ per cent.	
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 10 p.c. off	

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 100-lb. kegs, per cwt	6.75
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.71
Linseed oil, boiled, single bbls.	0.74
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

1/4 inch	$8.00
5/16 inch	5.35
3/8 inch	4.60
7/16 inch	4.30
1/2 inch	4.05
9/16 inch	4.05
5/8 inch	3.90
3/4 inch	3.85
7/8 inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	35 & 5%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 80	$2 80
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 00	4 05
Apollo brand, 10¾ oz. (galvanized)	4 10	4 00
Queen's Head, 28 B.W.G.	4 25	4 45
Fleur-de-Lis, 28 B.W.G.	4 00	4 35
Gorbal's Best, No. 28	4 50	4 55
Viking metal, No. 28	4 00	4 10

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., March 1, 1915.—Industrial conditions have not manifested many changes during the past week. Business in steel has been very quiet. The spring building has not commenced to come in, although the increasing number of inquiries would indicate that orders in this line will soon be on the books of various concerns. Business in structural work from Europe has been under consideration for some time past by various American and Canadian firms, and some of them have their representatives overseas now soliciting orders. Pig iron still remains very quiet. Machine tools do not present much activity, although the manufacture of shrapnel shells continues to create a demand for a certain class of tools. Metals have not been active during the week, but prices have had a tendency to stiffen.

The Steel Market.

The manufacture of forgings for steel shells has kept many eastern mills busy of late, and the Algoma Steel Corporation have been quite busy filling rail orders. Generally speaking, the volume of business passing is small. In the neighborhood of Pittsburgh, Carnegie interests are expected to buy steel scrap and this had a tendency to bull the market. On the other hand, however, other mills, with one possible exception, have

manifested no interest whatever, and this has had a bearish influence; thus dealers in scrap steel are in a quandry as to how best to interpret the situation. The railways have done little purchasing of late owing to their reduced revenues and the steel interests suffer more than perhaps any other line, because of this.

Pig Iron.

Pig iron business is practically dead. Such large supplies were purchased early in 1914 at the low prices then prevailing that with the curtailment of our manufacturing owing to the war, these supplies are more than ample to take care of present needs. The recent increases due to the new tariff will tend to make business still quieter for some time to come.

Machine Tools and Supplies.

The same rather peculiar situation in machine tools continues to exist from week to week. The demand for shell-machinery continues to increase and producers of these machines are working overtime to fill contracts, the deliveries of which are far too slow to suit the various purchasers. In other lines business is very quiet. The supply business keeps up well and is even increasing because the steel industry is assuming greater proportions each week.

Metals.

Business in metals during the last week has been somewhat better than that of the immediately preceding week. Prices generally have stiffened. Copper, however, is selling the same as last week. It is rather a matter for speculation as to which way the price will go. If naval operations in the European waters are such as to render the shipping of copper too risky, the price will drop as the supply accumulates on this side of the Atlantic. However, if shipments continue the price will likely rise a little.

Tin is up one cent a pound. The market is in rather an upset condition although supplies are quite adequate for all demands.

Spelter has increased in price and is now selling at eleven cents. This market too is very unsettled.

Lead has experienced a little stiffening in price and stocks on hand are fairly large.

Aluminum was featureless during the week, the price remaining the same with no indication of a change.

Antimony has been quiet but firm, no possibility of obtaining any of this metal from European sources being immediately in prospect. It is rumored that Russia has purchased large quantities from China and Japan and the supply for American requirements looks very slim indeed.

The London Exchange closing quotations to-day were:—*Standard tin £183; copper £64⅝; lead £20¼; spelter £43.

*Tin up £3 per ton to-day.

Toronto, Ont., March 2, 1915.—There has been no appreciable change in business conditions this week. Trade is quiet in most industries, except where factories are engaged in the production of military equipment. The tariff revision has caused some inconvenience in business circles, but the necessary adjustments are gradually being made. Business does not seem to have been materially affected by the higher tariff. Buying has been on a more or less restricted scale for some time, and consumers will have to buy for urgent needs, regardless of the extra cost. There has been a general advance in prices on imported goods to cover the extra duties, and also, in many cases, on domestic products on account of the increased cost of raw materials. Other increases are contemplated, and in some instances price lists have been withdrawn pending a revision.

The steel trade is dull, but the outlook is improving, and prices have stiffened. There has been less activity recently in machine tool circles, but there will no doubt be a revival as the shell industry develops, indications pointing towards this. Prices on machine shop supplies are still being revised. Scrap copper and brass have advanced ½c per pound, but business is very light.

Steel Market.

There is no change in the general situation in the iron and steel trade, it being still comparatively dull. Orders for shells are increasing in volume, and some business is being booked on account of other orders for military supplies. Indirectly the steel trade is deriving further benefit from the war, as regards extensions and improvements to factory buildings and plants. The outlook is improving, and it is expected that the new tariff will have a generally beneficial effect. There are no changes of note in quotations, although prices have stiffened. Galvanized sheets are firm and unchanged, but an advance is probable. The steel trade in the United States continues to improve, and mill operations are showing more activity. There has been another advance of $3 a ton on galvanized sheets, due to the high price of spelter.

Pig Iron.

The situation with regard to pig iron shows no improvement. The demand continues light, and the advanced prices will not improve the outlook.

Machine Tools.

The demand for machine tools in connection with the shell industry has fallen off, although there are still a number of inquiries being received from firms which are contemplating working on shell orders. There are, however, possibilities of further developments in the shell industry. Although fewer orders for 15-lb. and 18-lb. shells are being distributed, it is understood that lyddite shells and also shells of larger calibre will be manufactured in Canada. This will give a further impetus to the machine tool business. Apart from this, local dealers report dullness. Interest will be revived by the specifications for new equipment for the new Toronto Technical School, which will be found in the Industrial News Section of this issue. The list includes wood and metal working lathes, foundry, forge and machine shop equipment.

Supplies.

The demand for machine shop supplies is showing some improvement. There have been some more price changes; bolts, nuts and screws, iron rivets and proof coil chain being affected. Other lines, such as leather belting, rope, linseed oil, are expected to advance. Prices have been withdrawn on milled screws and nuts pending a revision of the lists. There is a better demand for the best grades of high-speed tool steel from shell manufacturers.

Scrap Metals.

The market is dull and very little business is moving. Prices on all grades of copper. The new prices are given ½c per pound, due to the increased cost of copper. The new prices are given among the selected market quotations.

Metals.

Business is quiet in the local markets, but prices are firm, due to the strength of the primary markets. Tin and spelter have both advanced, but other metals are unchanged.

The tin market is firm in London, particularly as regards futures. The local market has advanced 1c, tin being now quoted at 44c per pound. The copper market is quiet and unchanged. There is no improvement in the export and shipping situation, the same difficulties in this respect continue. Local quotations are firm at 16½c per pound for lake copper. The extraordinary condition in the spelter market continues, and the situation is strained. Quotations are ½c higher, but purely nominal at 11¼c per pound. The lead market in New York is quiet, but very strong, and higher prices are anticipated. Lead is firm in the local market at 5¾c per pound. Antimony is firm, but unchanged, at 20½c per pound. Aluminum is unchanged at 23½c.

St. John, N.B., Feb. 27, 1915.—Despite the fact that the war has had a tendency to lessen the promotion of new industrial

enterprises in many parts of Canada, business has been so thoroughly satisfactory in the Atlantic Provinces that the slogan "Business as Usual" has no empty sound—it is full of significance and being strictly adhered to. Various industrial concerns have been favored with military contracts, and this has helped sustain general business. The greatest interest now centres in the matter of the spring opening of the lumber trade. Just at present there is concern in different parts as to whether or not the snowfall will be adequate to allow of successful operations for the marketing of the cut. The quantity of snow which has fallen thus far has been fair in northern New Brunswick but along the southern centres it has not been satisfactory. Heavy rains this week may mean the tying-up of large quantities of logs. As the success or failure of the lumbering business generally reflects very much on other branches of industry, the matter is of keen importance to all.

Trade Notes.

Under the name of Robinson, Ltd., with an authorized capitalization of $99,000, a new lumber company is seeking incorporation at Millerton, N.B. The applicants are James Robinson, Weldon Robinson, Homes A. Frank, Mrs. Susan G. Frank and Grace Robinson of Millerton, and they plan to carry on the business of James Robinson, ex-M.P.

The Portland Rolling Mills at St. John, N.B., have been awarded a large contract for the supply of steel to the Intercolonial Railway. It will keep them busy for some time. T. McAvity & Sons have been given a Government contract for the supply of brass plugs for shells for army use. The Phoenix Foundry, another local concern, has a large order for the manufacture of shrapnel cases.

Lumberman Dead.

Charles T. White, senior member of the lumbering firm of Chas. T. White & Son, of Sussex, N.B., is dead at his home there, aged 76 years. He was an extensive lumber operator, and had mills at several points.

New Industry.

The handsome and up-to-date plant of the Atlantic Sugar Refineries, Ltd., in St. John, is now grinding out its daily stock of sugar for wherever a market serves. The machinery installed, and the appliances used, are the most modern of any in Canada, and the plant is the largest of its kind in the Dominion. The capacity of the plant is one hundred and fifty thousand tons yearly.

Kingston, Ont.—The Canadian Locomotive Co. has asked its former employees to register at the time office. This is being done so that the management will know how many men there are about the city who will be available at a moment's notice to resume their former occupation.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS

Argentine Republic.
H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.
D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Cancoma.

British West Indies.
E. H. S. Flood, Bridgetown, Barbados, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.
J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.
Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.
Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.
G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.
J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.
W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.
W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.
W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.
E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.
J. E. Ray, Central House, Birmingham. Cable address, Canadian.
Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.
F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.
Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Canacom.
Harrison Watson, 72 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.
Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.
R. H. Curry, Nassau, Bahamas.

Colombia.
A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.
C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.
D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.
E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.
W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Woodstock, Ont.—Fire on February 26 damaged the factory of the Canadian Morehead Co. to the extent of $25,000.

Port Dover, Ont.—The Lake Erie & Northern Railway Co. contemplates building a round house and machine shop here.

London, Ont.—The council propose installing electrically-driven pumps at the Springbank pumping station. H. C. Glaubitz is manager of the waterworks department.

Windsor, Ont.—R. E. Hart, Flushing, Mich., has purchased site in No. 2 Factory District, and will erect a factory for making scale attachments.

Hamilton, Ont.—The Canadian Horse Shoe Co., a branch of the United States Horse Shoe Co., of Erie, Pa., will be incorporated with a capital of $300,000. A site has been purchased and building operations will be commenced shortly on a plant to cost about $150,000. L. A. McIlroy is president and general manager.

Fredericton, N.B.—Notice has been given of an application to be made to the Legislative Assembly at its ensuing session, for the passing of an Act to incorporate the St. John River Hydro-Electric Company, to acquire and develop a water power on the St. John River at Pokiok, about 35 miles above Fredericton.

Welland, Ont.—The Canada Forge Co. is making extensive additions to its plant, which will be completed in a few weeks. An addition 100 ft. by 100 ft. is being built to the forge shop by the Standard Steel Construction Co. In this will be installed three more hydraulic presses. The Forge Co. has also contracted with the Hydro Commission for 200 additional electrical horse-power.

Electrical

Brockville, Ont.—The hydro-electric line from Prescott to Brockville is nearing completion and work is being rushed on the transformer station.

Toronto, Ont.—The construction of a hydro-radial line from Bracebridge through to the Wa Wa Hotel and ultimately extending to the Algonquin Park headquarters, is under consideration. Sir Adam Beck has promised to give the matter every consideration.

Renfrew, Ont.—The council having sold their debentures, have decided to proceed with the installation of the new street lighting system without delay.

Welland, Ont.—In a report to the council from the local Hydro Commission it was stated that the cost of increasing the transformer capacity from 600 to 1,200 h.p. would mean a capital expenditure of $3,500. The commission has also spent $22,232.78 on plant, being in debt to the Provincial Commission for this amount. The commission, therefore, recommended that the council raise $25,000 by debentures to provide for this amount.

General Industrial

Exeter, Ont.—W. G. Medd is making some improvements to his creamery at Winchelsea.

Perth, Ont.—Local industries are working full time on Government orders for military equipment.

Ottawa, Ont.—Grant, Holden & Graham are contemplating an addition to their tent and awning factory.

Sherbrooke, Que.—Julius Kayser & Co., of New York, makers of silk gloves, etc., have decided to locate here.

Montreal, Que.—The Ives Modern Bedstead Co.'s factory was destroyed by fire on Feb. 24. Loss is estimated at $75,000.

Medicine Hat, Alta.—It is understood that the Purmal Brick Co. will shortly re-open their plant here and start making brick.

Lindsay, Ont—An effort is being made to raise sufficient money to rebuild Horn Bros. woolen factory, destroyed by fire some time ago.

Toronto, Ont.—Wickett & Craig's tannery at Cypress Avenue was damaged by fire to the extent of $2,800 on Feb. 18. The loss is covered by insurance.

Sarnia, Ont.—The Imperial Oil Co. is planning considerable extension to the works here, including some stills, which will give employment to a large number of men.

Montreal, Que.—The Canadian Consolidated Rubber Co. announces that it will make a million-dollar issue of 7 per cent. preferred stock at par immediately. The proceeds of the issue are to be used in enlarging the Berlin tire factory, and also some departments at the Montreal plants.

Brampton, Ont.—Henry Abell has leased the Abell Works here to Ed. R. Lewis of Toronto, who intends to open a factory for preparing sheep skins and other leather goods.

Harriston, Ont.—The Harriston Furniture Co. and the Harriston Stove Foundry Co., after being shut down for some time, have opened up, and are working a ten-hour day.

Winnipeg, Man.—The Canadian Broom Mfg. Co. has been incorporated to manufacture all kinds of brooms and brushes. The head office will be here and the company is capitalized at $20,000.

Elora, Ont.—The Elora Textile Co., of which D. F. Stewart is manager, has taken over the S. S. and O. S. Sugden woolen mill at Hawkesville, Ont., and is equipping it to be operated as a spinning plant for the manufacture of hosiery and sweater yarns.

Brockville, Ont.— A new industry for Westport shortly will be the manufacture of Victoria Polish, a product made from feldspar. J. M. Stoness & Sons intend installing the machinery to manufacture the polish. The polish is used for cleaning nickel, silverware, kitchen utensils, etc.

Toronto, Ont.—It is reported that the Curtiss Aeroplane Co. has rented a factory building from the Steel & Radiation Company, Fraser Avenue, which will be used for the manufacture of aeroplanes. J. D. A. McCurdy, the Canadian aviator, is one of the heads of the Curtiss Co., which has recently been incorporated at Ottawa.

Municipal

Paris, Ont.—The council propose to install two water purification plants.

Vegreville, Alta.—The town will build an electric lighting plant. An injunction brought by T. A. Weeks has been dismissed in the Supreme Court of Alberta.

Kamloops, B.C.—A by-law is contemplated to raise $35,000 for waterworks and $40,000 for electric lighting purposes.

MECHANICAL EQUIPMENT REQUIRED FOR NEW CENTRAL TECHNICAL SCHOOL, TORONTO.

The Advisory Industrial Committee of the Board of Education, Toronto, will receive sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, W. C. Wilkinson, on or before Monday, March 8, 1915, for the following items of equipment for the New Central Technical School. Plans and specifications may be seen at the office of the Technical School, 149 College Street, Toronto.

FORGE SHOP.

20 Anvils.
19 Forges with hand-driven fans.
1 Forge with compressed air injector.
1 Grinder.
1 Shear and punch.
1 Power hammer.
1 Drill.
1 Motor.
4 Pneumatic hammers.
21 Hand hammers.
21 Squares, graduated.
2 Cold chisels, with handles.
2 Hot chisels with handles.
2 Ten-pound sledges.
Dies for power hammer.
2 Vises.
1 Gas furnace with pyrometer.
1 Heating furnace.
1 Swage block mounted.
2 Button sets.
All anvils to be furnished with individual sets of tools and coal boxes.
10 each top and bottom fullers ¾ in. x ½ in.
10 each top and bottom swages, ¾ in. x ½ in.
10 Flatters.
10 1¼ in. set hammers.
2 Round punches—⅜ in.
20 Heading tools—⅜ x ½.

FOUNDRY

1 Cupola—26 in. shell.
4 Brass furnaces with fire brick linings.
8 Crucibles.
Grating for furnace pit.
Air hose and piping.
3 Air injectors for cupola and brass furnaces.
1 3-ton traveling crane.
1 Pneumatic or electric hoist.
2 Lifting tongs.
1 Chain hoist (fastened to platform.)
2 Molding machines equipped with patterns and stripping plate.
1 Matched plate.
1 Complete stripping plate machine.
1 Pneumatic vibrator.
2 Pneumatic hammers.
1 Tumbling barrel (with extra parts.)
1 Sand blast outfit.
1 Grinder.
1 Pickle tank.
1 Core machine.
1 Core oven.
12 Hand ladles.
1 Crane ladle.
30 Flasks.
20 Snap flasks.
24 Lifting screws.
24 Vent rods.
24 Riddles.
4 Hand bellows.
10 Rawhide mallets.
10 Blow pipe sprayers.
60 Slicks.
60 Spoons.
10 Gate cutters.
20 Camel hair brushes.
20 Banister brushes.
20 Swabs. 10 Sprue cutters.
40 Bench rammers. 4 Floor rammers.
1 Coke fork. 6 Shovels.
10 Copper swab pots.
2 Sprinkling cans.
12 Small shovels fire shovels.
1 Lead melting pot.
1 Pneumatic riddle shaker.
3 Bolt sticks. 1 Platform scale.
2 Tapping bars 1 Tapping chisel.
Molding sand. Pails.
Coke bins. Sand troughs.
Wheelbarrows.
Single and double picks.
1 Heavy ball pean hammer.
1 Heavy sledge 20 lbs.

MACHINE SHOP.

1 Speed lathe—10 in.
1 Precision bench lathe with all milling and gear cutting attachments.
14 Plain engine lathes (special), cone drive, taper attachment, and standard equipment, interchangeable parts, etc.
6 Tool room lathes — with relieving attachments, taper attachment, draw-in chucks and collets—lathes to be of different makes.
1 Metal planer—24 in. x 24 in. x 6 ft., 4 speeds, independent motor and planer vise.
4 Shapers, with vises complete.
2 Universal milling machines complete.
1 Circular milling table.
1 Universal vertical milling head.
1 Profiling head.
2 Plain milling machines.
4 Dividing heads and centres, complete.
1 High speed drill with 12 in. overhang—motor drive.
1 2-Spindle sensitive drill with speed gear box. 1 Semi-automatic.
1 Tool grinder.
1 Drill grinder.
2 Universal grinders—motor driven.
2 Plain cylindrical grinders—motor driven.
1 Arbor press.
1 Hardening and tempering furnace with pyrometer.
1 30 in. boring mill.
1 16 in., 32 in. extension gap lathe—motor driven.
1 Die slotter.
1 Punch press.
Pulleys, silent chain drives, shafting, belting, etc.

WOODWORKING MACHINERY.

24 Cone driven wood turning lathes, 14 in. swing.
1 Wood turning lathe with compound rest 20 in.
4 Water tool grinders.
3 Band saws, 36 in.
2 Disc and spindle sanders.
1 Universal saw table.
1 Self-feed rip saw.
1 Table cut-off saw.
3 Variety saws.
2 Bench jointers
1 12 in. jointer.
1 16 in. jointer.
1 30 in. surfacer.
1 Mortising and tenoning machine.
2 Hollow chisel mortisers.
1 tenoner with double cope heads and cut off saws.
1 Double spindle shaper.
1 Pneumatic sander.
1 Belt sander.
1 Boring, routing, and sanding machine.
1 Veneer press.
1 Saw vise.
1 Knife balancer.
1 Fan dust collector, separator and tank.
1 Saw grinder.
1 portable wood worker.
All machines direct motor driven except cone driven lathes.

TESTING MACHINES.

1 Cement tester.
1 Standard screw power testing machine with power drive and completely equipped for round, flat, and square specimens for tensile, compression and transverse tests, also extensometer, compressometer and transverse indicator.
1 Hydraulic compression testing machine for brick, stone and cement, with two gauges.
Weigh scale, moist chamber, gilmour needles and 50 moulds.

STEAM ENGINE LABORATORY.

1 Plain slide valve steam engine with special eccentric fastenings for valve setting adjustments—20 25-h.p.
1 Automatic engine with inertia governor and adjustable fly wheel for valve setting adjustments—20-25 h.p.
1 Gas engine with governor adjustable for speed regulation.
1 Steam turbine with dynamometer or direct connected dynamo.
1 Surface condenser.
6 Thermometers for steam and water.
3 Steam calorimeters.
1 Coal calorimeter.
2 Steam gauges.
2 Vacuum gauges.
1 Gauge tester.
4 Indicators with reducing motions.
2 Planimeters.
All engines and machines to be fitted with water and drain pipes, hollow pulleys, prony brakes, piping, bends, valves, fittings, thermometer wells, calorimeter connections, indicator connections, gauge connections, etc., complete.

ELECTRICAL APPARATUS.

2 Motor generator sets—2 115 or 230 volt interpole D.C. motors direct connected on base plates to 2 compound wound generators to deliver 200 amps. at 6 volts. All complete with field rheostats, starting boxes, no voltage release, no switches.
Above to be guaranteed for a rise not over 40 deg. C. in temperature.
3 Transformers 1 K.W. from 110 volts and 220 volts to 1100 and 2200 volts, 60 cycles.
1 Rotary converter, 125 volts, 40 amps. on D.C. end, or about 5 K.W. for 60 cycles.
1 Motor generator set 20 h.p. 220 volt, interpole motor running just under 1000 r.p.m. direct connected to generator on same base plate by approved coupling for 110 volts, 60 cycle, A.C. current when running at 1200 r.p.m. To have six pole rotating field and rheostats to give large number of steps and overload release.
1 Motor generator set, 10 h.p. motor and 7½ K.W. generator, equipped with solid base plate, rheostats, starting boxes, etc.
1 Testing transformer, 10000 v. ½ K.W.
1 Series motor, D.C. 110 v. or 220 v. about 3¼ h.p., 825 r.p.m.
2 Interpole motors, D.C., 110 v. 5 h.p., about 1350 r.p.m.
2 Compound wound generators. D.C. 125 v., 3 or 4 K.W., with field rheostat \ a large number of steps, approved couplings, base plates, starting boxes, overload circuit breakers, etc.
6 Interpole motors, 4 or 5 h.p. at about 1200 r.p.m. or under, for 115 v. D.C. or 230 v. D.C. with switches, starting boxes, voltage release, circuit breakers, etc.
2 Interpole motors, 7½ h.p. (same as above except speed).
3 10 h.p. interpole motors (same as above except speed).
1 15 h.p. interpole motor (same as above except speed).
3 Spare armatures and circuit breakers
These motors to be in addition to those called for on individual drive machines, and all provided with hollow pulleys for breaks.

Trade Gossip

Orillia, Ont.—At a meeting of the Board of Trade the following officers were elected: President, M. B. Tudhope; vice-president, Frank S. Lewis; treasurer, Nelson Ball; secretary, Harold L. Kearns.

Ottawa, Ont.—It is stated here that an order for a million shells is being placed in Canada by the Russian Government following the visit to Petrograd of Senator Curry, head of the Canadian Steel Foundries, Ltd.

Sudbury, Ont.—The Board of Trade have elected the following officers: President, D. M. Brodie; P. Gorman, vice-president; Percy Morrison, secretary; council, Messrs. Peacock, Stafford, Beath, Evans, Henry, Duncan, Rieard, Moyle, McArthur, Mitchell, Seybold.

Orillia, Ont.—J. B. Tudhope, president of the Tudhope-Anderson Co., announces that F. S. Lewis, who has for some time been director of the company, has been elected vice-president and managing director. The other officers will remain as at present. These are: H. F. Anderson, general manager; Geo. E. Peacock, manager manufacturing department; R. S. Harder, eastern sales manager.

Canadian National Exhibition Executive.—Joseph Oliver was re-elected president of the Canadian National Exhibition at the inaugural meeting of the Board of Directors held in Toronto on March 1. The other officers are: Honorary President, John G. Kent; first vice-president, Noel Marshall; second vice-president, George Booth. Executive Committee—The officers and W. K. McNaught, Geo. H. Gooderham, W. K. George, Alderman McBride, Robt. Fleming, and T. A. Russell.

Sherbrooke, Que.—The annual meeting of the Board of Trade was held on Feb. 9, and the election of officers for the ensuing year resulted as follows: President, J. E. Poutrie; vice-president, D. J. Steele; councillors, Messrs. C. W. Cate, C. Beauchesne, E. W. Farwell, L. E. Chamberlain, V. E. Morrill, F. H. Hebert, E. J. Page, F. R. Darche, A. C. Skinner, G. H. St. Pierre, A. M. Sangster, J. O. Darche, J. W. McKee, A. U. Dorais, H. V. Haight, J. O'C. Migneault, F. H. Bradley, Gustave Richard, M. Echenberg, A. G. Sabourin.

Metal Manufacturers' Association. — The machinery and metal manufacturers of Ontario may form themselves into an association to reduce the risk of accidents in their factories and thus eventually reduce their assessments under the Workmen's Compensation Act. This association may select J. D. Thorne as chairman when it is formed. Other manufacturers are taking like steps for the purpose of reducing the number of accidents and thereby gaining lighter assessments.

Montreal, Que.—A meeting of the Toronto Terminal Co. was held here on Feb. 22, with H. G. Kelley, vice-president of the Grand Trunk, in the chair. There were also present Sir Thomas Shaughnessy, G. S. Bury, I. G. Ogden and Henry Phillips, secretary. The company, which represents the C. P. R. and Grand Trunk in the building of a new Union Station and viaduct at Toronto, is to issue special bonds to bring in something like $15,000,000, which sum it is understood will about cover the cost of the entire work.

Canada Machinery Corporation.—At a special meeting of the bondholders of the Canada Machinery Corporation, held at the head office, Galt, Ont., on February 18, and presided over by T. Gibson, of Toronto, the sale of the Hamilton property was authorized. This action, according to T. H. Watson, president and general manager, meant a concentration of the business at Galt and extensions to the plant there. The meeting also carried a resolution converting 50 per cent. of the bond issue into preferred stock and deferred the interest for two years.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Cornwall, Ont.—At the annual meeting of the Board of Trade the following officers were elected: President, C. H. Cline; vice-president, A. E. Currie; secretary, R. Dodd; treasurer, E. O'Callaghan; auditors, J. A. Chisholm, J. C. Alguire; councillors, P. E. Campbell, W. V. Boyd, J. C. Alguire, A. McCracken, J. E. Snetsinger, J. A. Chisholm, G. R. Phillips, N. J. Fraid, W. Hodge, G. A. Stiles, W. Gibbens, Dr. W. B. Cavanagh. It was decided to enter upon a vigorous publicity campaign, to secure some of the industries that will undoubtedly be established in Canada upon the cessation of the war. The board will act in conjunction with the Town Council, and the advantages of Cornwall will be extensively advertised in Canada and the United States.

Machinists' Ball.—The fifth annual ball given by the St. Thomas machinists in the engineers' hall on Feb. 15 was the most successful yet held. Over 600 guests were present and the hall was decorated in a fitting manner with patriotic colors, flags, etc. The music, furnished by Finzel's orchestra of Detroit, was of the highest order, and the selections were much appreciated by the dancers. At midnight a delightful and substantial lunch was served to which all did justice, testifying thereby to the goodness of the delicacies served. The committee who had charge of the ball, and who were responsible for its success were: Geo. Richardson, chairman; H. A. Vieary, secretary-treasurer; J. W. Boath, A. Buchan, J. Lane, J. Alexander, C. J. Rowley, H. Manning and R. Logan.

Transport Wagon Contracts.—Transport wagons to the number of 894 were purchased for the Canadian troops, according to a return brought down in the House of Commons on Feb. 23. The prices paid were $140 for heavy and $120 for light wagons. The heavy wagons were purchased from the American Road Machinery Co., Goderich, 60; Port Arthur Wagon Co., 45; International Harvester Co., Chatham, 50; Adams Wagon Co., Brantford, 37; Tudhope, Anderson Co., Orillia, 10; Smith Bros., Toronto, 50; Elsear Dore, La Prairie, 38; Metallurgic Enterprise Co., Sorel, 51. Light wagons were purchased as follows: Speight Wagon Co., Markham, 50; Petrolea Wagon Co., 80; Adams Wagon Co., Brantford, 30; American Road Machinery Co., 50; Woodstock Wagon Co., 67. Tenders were invited verbally.

Trucks Purchased by Government. — A return tabled on Feb. 25 in Parliament regarding the purchase of motor trucks for the first contingent shows that the number was 142, purchased as follows: Twenty-three from the Gramm Motor Truck Co., Walkerville, Ont., the makers; forty-three from the White Co., Toronto, made by the White Co., Cleveland, Ohio; twenty-five from Dominion Automobile Co., Toronto, made by the Peerless Motor Co., Cleveland, Ohio; twenty-six from the Russel Motor Car Co., Toronto, made by Jeffrey Co., Kenosha, Wis.; twenty-five from Russell Motor Car Co., made by Kelly, Springfield, Motor Truck Co., Springfield, Ohio. Of trucks with a 3½-ton capacity, 15 were built by the Gramm Co., and 25 by the Kelly, Springfield. The White Co.

built 38, and the Peerless 25 trucks of 3-ton capacity, while two-ton trucks were built, 26 by the Jeffrey Co., 8 by the Gramm and 5 by the White Co. The prices paid were: Gramm, 3½-tons, $4,-140; Gramm, 2 tons, $3,240; White, 3-tons, $3,330; White, 2-tons, $2,700; Peerless, 3-tons, $3,330; Jeffrey, 2-tons, $2,-470; Kelly, Springfield, 3½-tons, $3,105.

Personal

Hamilton, Ont.—The mayor will receive applications for the position of principal assistant engineer up to March 3.

Osgood McVean, senior member of the firm of O. & W. McVean, wheel manufacturers of Dresden, Ont., died there on Feb. 26.

F. Orr-Lewis, president Lewis Bros. and Can. Vickers, Ltd., Montreal, returned home last week, via New York, on the "Lusitania," from the Old Country.

C. S. Griffith, who has been representing the Queen City Oil Co. in the St. Thomas district, has been appointed manager of the Imperial Oil Co.'s business at Ottawa, and has left for that place.

Captain John McMulkin, for many years one of the best known St. John river steamer captains, for ten years an alderman in St. John, and New Brunswick's first factory inspector, died on Feb. 24, aged 79 years.

Richard Schofield, member of the Toronto firm of Schofield-Holden, machinery manufacturers, died on Feb. 26, at San Francisco, as the result of an operation for appendicitis. Mr. Schofield was in his fifty-ninth year, and leaves a widow, a son and daughter.

Frank Edward Norton, manager of the Norton Telephone Manufacturing Co., died on Feb. 19 at St. Michael's Hospital, Toronto. Mr. Norton was born 50 years ago at Fort Covington, N.Y., and had been engaged in the telephone business at Halifax and Montreal before coming to Toronto ten years ago.

Fred M. Hoadley, consulting engineer, 802 New Birks Building, Montreal, has been commissioned by the Bishop of the monastery at Oka, Quebec, to make a complete investigation into the possibilities of developing a hydro-electric plant upon the river running through the property adjacent to the monastery.

William Newman, naval architect of the Polson Iron Works, Toronto, has been awarded a commission with the rank of lieutenant in the 23rd Regiment Northern Pioneers, Owen Sound, his home town. He was formerly a non-commissioned officer in the 48th Highlanders and the 14th Princess of Wales' Own Rifles, Kingston.

John Oliver Parker, head of the J. O. Parker & Co. brass works, died on Feb. 27 at his residence, 162 Garden avenue, Toronto, aged 67 years. Mr. Parker was born at Birmingham, England, and came to Toronto when a young man. Practically all his life he was engaged in the brass business, and retired only a short time ago.

E. M. Breed, who for the past eight years has been district manager of the Canadian Allis-Chalmers, Ltd., with headquarters at Vancouver, B.C., has been appointed district manager of the Pelton Water Wheel Co. He will continue his headquarters at Vancouver. Mr. Breed is a graduate of the University of Maine, college of technology, and is a member of the American Institute of Electrical Engineers. Previous to becoming manager for the Canadian Allis-Chalmers Co. he was with the sales force of the Canadian Westinghouse Co., at Montreal.

Tenders

Toronto, Ont.—Tenders for transformers, addressed to the Chairman, Toronto Electric Commissioners, will be received until March 11, 1915. Specifications and form of tender may be obtained at the office of the Purchasing Agent.

Winnipeg, Man.—Tenders addressed to the Chairman, Board of Control, will be received up to Monday, March 22, 1915, for the supply of storage batteries for the new Central Fire Alarm Office equipment. Specifications may be obtained at the office of the City Electrician, Olafsen Block, Winnipeg. M. Peterson, Secretary.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, City Hall, up to Tuesday, April 13, 1915, for the supply of automatic valves and check valves. Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall.

Port Hope, Ont.—Tenders will be received by the secretary of the Board of Water Commissioners until March 15 for the following work and materials:—Contract 3—Low-lift centrifugal pumps, motors, oil engine, piping and erection of same. 4—Venturi tubes, loss of head gauges, elevation gauges. 5—The construction of four slow sand filters, pump house and pure water reservoir. 6—Cast iron pipe and specials. 7—Valves and valve boxes. Plans may be seen and specifications obtained at the office of the engineers, F. W. Thorold Co., Ltd., 2 Toronto Street, Toronto, Ont.

St. Catharines, Ont.—Tenders will be received by the architect until Monday, March 15, 1915, for all trades required for the erection and completion of a new Collegiate Institute to be erected in St. Catharines, Ont. A complete set of plans and specifications may be seen at any reasonable time at the office of the architect, 46 Queen Street, St. Catharines, Ont. Contractors wishing to obtain a set of plans and specifications for estimating may do so upon application to the architect and depositing with him a marked cheque for $25.00. A. E. Nicholson, O.A.A., architect, St. Catharines, Ont.

Fredericton, N.B.—Tenders will be received at the Department of Public Works, Fredericton, until March 31, 1915, for constructing the steel superstructure of a new bridge, to take the place of the present wooden highway bridge at Moncton over the Petitcodiac River; one through fixed riveted steel truss span of 355 feet from centre to centre of end bearings; four through fixed riveted steel truss spans of 261 ft., 6 in. from centre to centre of end bearings, according to plans and specifications to be seen at the Public Works Department, Fredericton, N.B. John Morrissy, Minister of Public Works.

Toronto, Ont.—The Advisory Industrial Committee of the Board of Education will receive tenders, whole or separate, addressed to the secretary-treasurer of the Board, on or before Monday, March 8, 1915, for the following:

(1)—Special electric fixtures.

(2)—Tile and plaster work in engine-room.

(3)—Electric Fixtures for all class-rooms and corridors.

(4)—Lavatory Switchboards.

(5)—Exhaust Fan for Forges.

(6)—Furniture and Equipment, including: Classroom Desks and Chairs; Laboratory and Shop Benches; Cases and Fittings; Office, Auditorium and Lecture-room Furniture; Science Equipment; Steel Lockers; Printing Material and Presses; Woodworking Lathes; Machine Lathes; Foundry, Forge and Machine Shop Equipment; Blinds, Curtains, Ranges; Laundry Equipment, etc.

Plans and specifications may be seen for items Nos. 1 and 2 at the offices of the architects, Ross & McDonald, 828 Traders' Bank Building; for items Nos. 3, 4 and 5, at the offices of the engineers, Canadian Domestic Engineering Co., 47-51 King street west; and for item No. 6, at the office of the Technical School, 149 College street. W. C. Wilkinson, Secretary-treasurer.

Some Jig Making Practice Considerations and Comment—I.*

By M. R. Lawrence, M.I. Mech. E.

We have come to look upon jigs and fixtures as such highly indispensable accessories to every class of mechanical engineering equipment manufacture that we may be apt in many cases to press them into service unwarrantably. The writer in this paper seeks to point out that their cost feature should be recorded carefully in every instance so as to ensure that they have been profitably applied, as well as being contributory to quality production.

THE author has several times been asked the apparently simple question, "What is a jig?" Chambers's dictionary says that it is a quick lively tune, or a quick dance suited to the tune. Engineers attach a different meaning to the word, but in so far as the meaning of the word is "quick and lively," is applies equally to engineering, music and dancing. We all, as engineers, look upon a jig as a device to aid, speed-up, and cheapen the making of parts which have to be alike. It stops short of the machine-tool or bench upon which it is used, and also any special or ordinary tools which actually do the cutting or holding of the cutters. Sometimes when the function of jigs is mostly the holding of the work they are termed "fixtures," and sometimes when quantities are very large they develop into special machine-tools.

The vast majority of special jigs, fixtures, tools and gauges are made to lessen the cost of production. A device may be said to do this and pay directly if its cost, plus the cost of machining the quantity of parts, is less than without it; and indirectly, when the accuracy it transmits to the pieces saves cost in the fitting-shop, or increases the production of a particular machine-tool, although the cost of the device and the cost of producing the individual parts added together is more than without it.

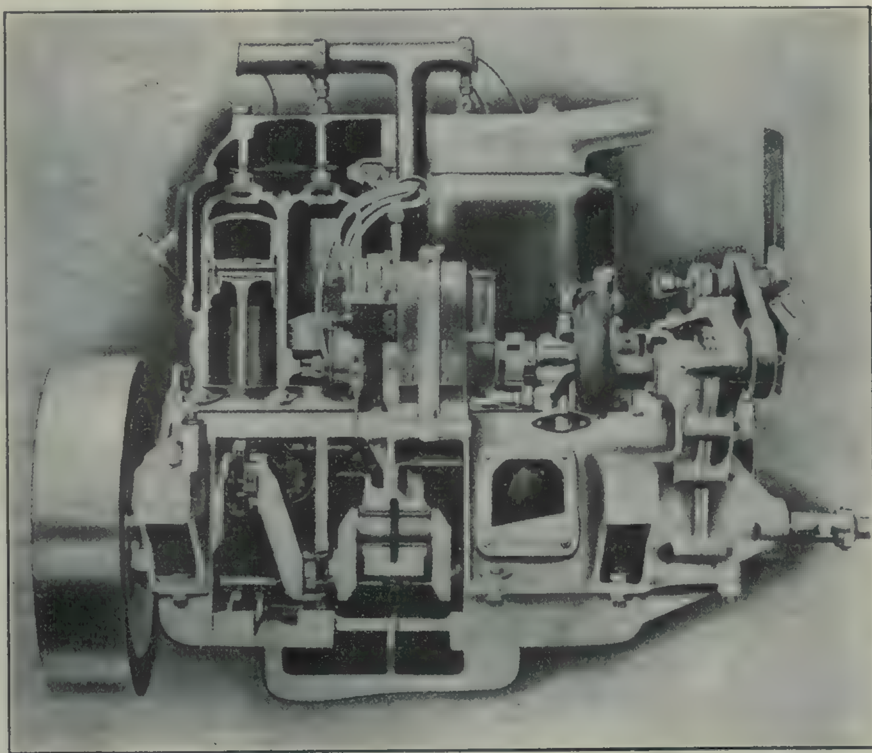


FIG. 2. SECTION OF ENGINE SHOWING CYLINDERS MOUNTED ON CRANK CASE.

When a quantity of similar pieces has to be made, the question of what jigs should be made always comes up, and a correct decision of what to make, and how to make it, is often difficult. When the quantities are very small or very large, the decision is usually easy, but when the quantity is between the two, it is often extremely difficult. Stripped bare of all engineering interest and skill, the problem is found to be almost entirely financial. The questions always uppermost in the mind when considering doubtful cases are: "Will it pay?" "Is the trouble and expense justified?" or "Is it better to leave well alone and go on in the good old way?"

Jig Costing.

It is, therefore, essential, in the author's opinion, to have a costing system which records the cost of the individual pieces, and also individual jigs, tools, and gauges, etc., not so much to ascertain how the money is spent at the time, which is important, but so that it may be known, when required, whether the estimated saving of a jig had ac-

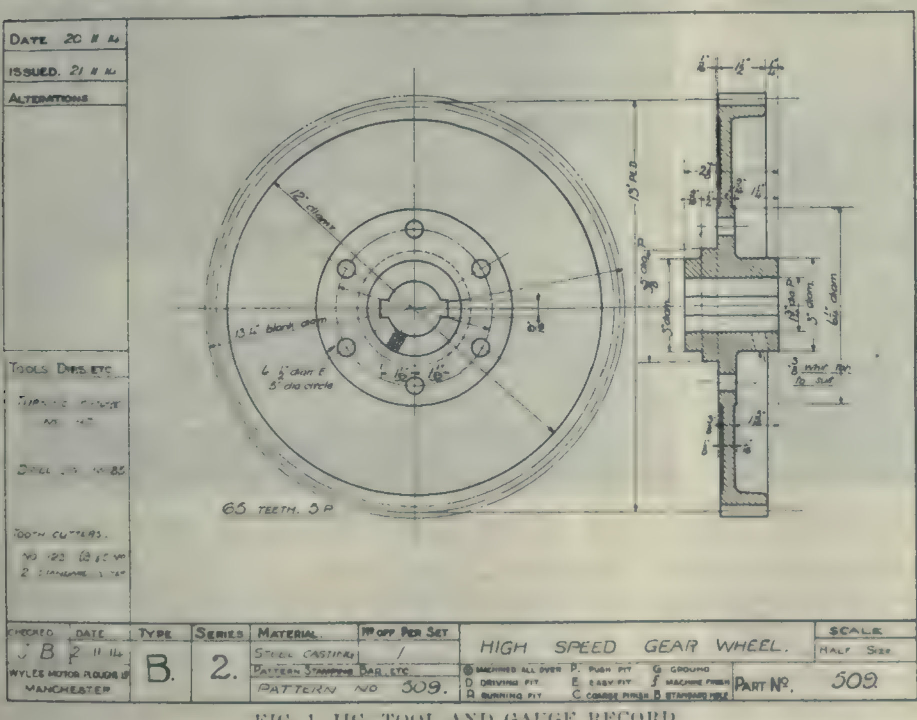


FIG. 1. JIG, TOOL AND GAUGE RECORD.

*Paper read before the Manchester Association of Engineers, December 12, 1914.

tually accrued. This is of great educative value, and aids such decisions in the future. The author considers this so important that he hopes to be forgiven if he just roughly indicates how it may be readily done.

FIG. 3. MILLING MOTOR CAR ENGINE CYLINDER.

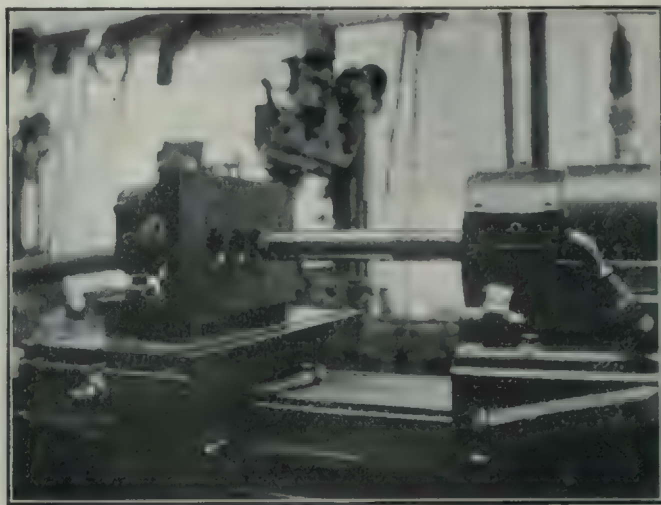


FIG. 5. INTERNAL GRINDING M.C. ENGINE CYLINDERS.

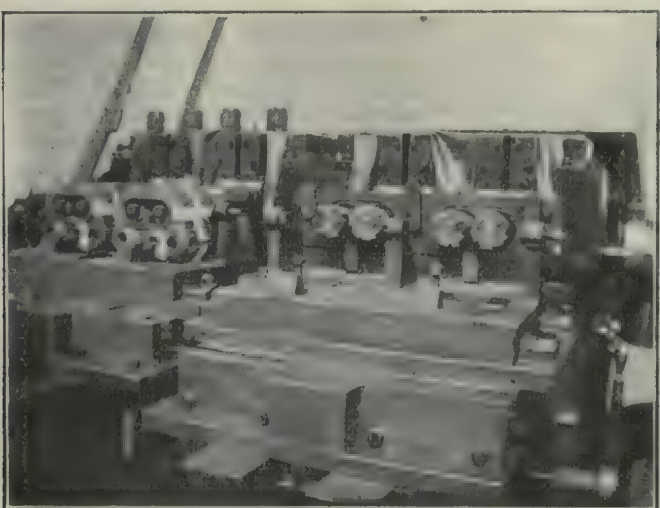


FIG. 4. MOTOR CAR ENGINE CYLINDER SET FOR BORING.

FIG. 6. MILLING CYLINDER SEATS ON CRANK CASE.

All works' accounts in their original form carry the necessary data. Each workman books his time separately, whether he is engaged on making jigs, parts to sell, or repairs, or whether he is paid day-work or by the piece. Each stores' requisition for material issued also gives such separate particulars. Why should these ever be mixed up in the office? Some fifteen years ago, when the author was engaged to lay out and manage a works in the Midlands, he devised and installed a system whereby individual costs of the parts made were obtained. The method adopted for costing jigs can quite easily be used in any works without any interference with the cost system in use, whatever it may be. It is as follows:—

All jigs, tools, and gauges should be numbered. These numbers, with the prefix T for tools, G for jigs and gauges, can be used as the order-numbers to which their cost is booked. By grouping numbers for different designs, a total jig-cost can readily be accurately produced. The order-number for any repairs or adjustments to them is charged to R T or R G as a prefix to the number. This is very convenient, because repairs always have to be put in hand instanter by the foreman, and this makes it easy for him to book the cost correctly.

Close experience over a number of years of this method of dealing with this important side of jigs, tools, and gauges has given the author confidence. It minimizes the evil of having open order-numbers running for long periods in the works, which sometimes form such a convenient dumping-ground for waste labor. It has many other advantages, not the least of which is the power to deal quickly with the suggestions of foremen and operators. They usually take the form of a request for some jig or tool which will lessen the cost of production. Often, time does not permit the management to go into the question closely, especially when one's experience rules the matter out of court at sight.

In these cases it is often extremely difficult to avoid giving offence, and, moreover, one's judgment may be at fault. The author has found, when the applicant has to supply the answers to the questions: "How much each will your jig save?" "How many are there to be made?" "What will the jig cost?" that the matter can be settled out of hand to everybody's satisfaction. When the policy of the management as to the amount of saving to be capitalized becomes known, only useful suggestions are put forward. The author considers that taken as a general rule, a jig should not cost more than 75 per cent. of the saving it brings about. Thus, if a jig is contemplated to save 1 cent each for 100 parts, it should not be made unless its cost is less than 75 cents.

The number and operation for which jigs, tools, and gauges are used should be recorded on the drawing of the piece. This may be done either by records on

the tracing, Fig. 1, or by sticking a list on to the works' print. This will involve a small delay in issuing orders for jigs, but the great convenience to the works makes it well worth while. These records of jig numbers on the drawings save a great deal of time, trouble, and money in the works, especially when replacements have to be made for designs no longer current. When a proper system is installed for dealing with this, no delays arise.

Jig Design—"Spotting Point" Location.

In jig design the most important point is the correct location of "spotting-point" of the piece. Often far too little attention is paid to this, and the larger the quantity to be handled the more important it becomes. There are two golden rules which should be rigidly observed:—

1.—In order that a jig or tool may be successfully located, the accuracy of any machining operations must never be increased beyond the requirements of the function of the part; and 2, which is really the same—in other words, that no extra face or part be machined for location purposes only.

Accuracy costs money, and live foremen and operators only trouble about it to the degree necessary. Hence, when a piece is not strictly to drawing, and the inaccuracy is unimportant to the proper function of the part, it should pass on to the next operation. If, however, the inaccuracy becomes material because it affects the location in a subsequent jig, it calls for special treatment, and unnecessary waste is made, or the jig put out of action for all or a percentage of pieces. The same principle applies to the location of thin castings with cores. They must be located from the correct places, so that if the cores have been misplaced, the error is detected before an undue amount of work is put upon the castings. Corollaries to these rules are:—

1.—The greater should never be located from the less. If this is done, slight errors multiply, and conversely are minimized.

2.—When two operations have to be true to one another, the second should always be located from the first. If the first is generated from another face, it is wrong to locate the second from this face where great accuracy is required. Pieces are sometimes not properly placed in jigs; dirt or burrs may get between the locating faces. This may not be serious if the next operation copies the inaccuracy so introduced, but may cause waste when this rule is departed from.

The machining of two pieces, a motor-car cylinder and its crank-case, will be described to illustrate these important points. The crown and barrel of the cylinder are made as thin as possible, so that the heat may readily escape through them to the water in the jacket. It is important that their thickness should be approximately even, because differences cause distortion due to the difference of temperature between the thick and thin sides. The jacket cores which determine this thickness are built up, and may be misplaced, so that if the casting is located from the outside of the jacket, it may "clean up" all over and yet not leave an even thickness of metal around the barrels. It is defects of this nature that probably account for the mysterious differences in form between engines of the same design so often noticed and commented upon.

Fig. 2 is the section of an engine showing the cylinders mounted upon the crank case. It will be observed that the location between the two which secures alignment is the flat face on the cylinder-foot meeting the flat face on the crank-chamber in the one direction, and the bolt-holes are used to locate them in the other. The water-jacket around the cylinder is too restricted in area to allow of a fixture being introduced of sufficient size to locate the casting truly by the outside of the barrel, and take the force of a cutter while any face is machined. The casting is, therefore, set up on a surface-plate, and marked out. Bent scribers of a suitable shape are used, and when the casting has been set up true to the outside of the barrels, lines are scribed upon it. The first operation is to set the casting up, and mill the foot true to the scribed lines.

The second operation, Fig. 3, shows it standing on this face and being machined on the side of the carburettor and the top of the water-jacket, the castings for these two operations being mounted on plates carrying convenient faces for the scribing-blocks to work from while setting.

The cylinders are then bored on a special machine, illustrated in Fig. 4, the casting being strapped tightly on to the machined foot, and located for height on the carburettor face, and set true sideways again to scribed lines. The barrels are then rough bored, the castings taken off, and allowed to cool and season for at least twenty-four hours, after which they are mounted again on the other side of the machine, and a cut taken to within one-hundredth of an inch of the finished dimension. The rest of the machining of the castings, the valve-guides, ports, and the holding-down bolt-holes, are located from the foot and the bores, to which they have to be true, and the final operation is illustrated in Fig. 5, where the whole casting is set up on the foot, and located from the holding bolt-holes, while the barrels are ground absolutely true and to size.

In scheming for these jigs and deciding upon the sequence of operations, a much simpler set could have been constructed had a datum face been ma-

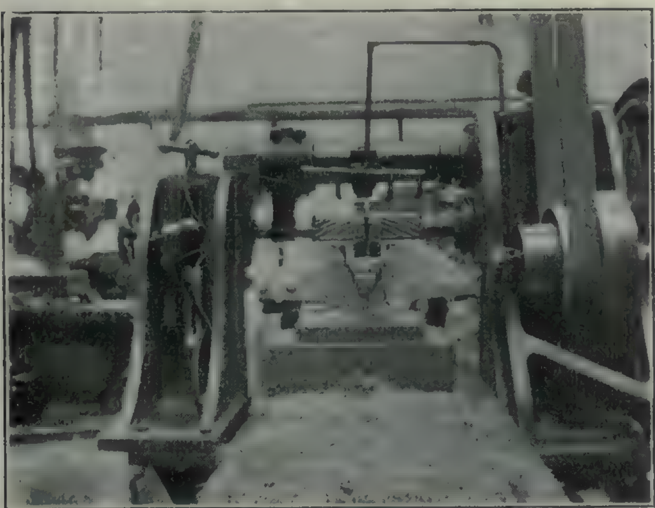


FIG. 7. MILLING PLUMMER BLOCKS ON CRANK CASE.

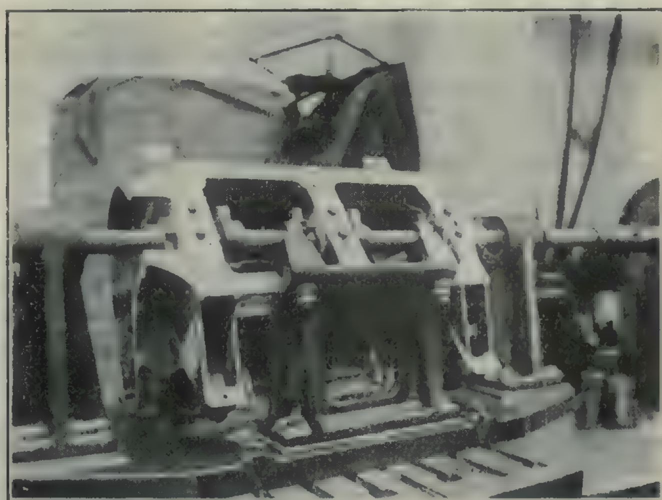


FIG. 8. BORING CRANK CASE.

chined for location purposes, and at one time this practice was followed. It, however, produced very bad work and barrels of very uneven thickness, because, when the metal had been removed from the bore and the foot, where it was left very thick for casting reasons, and the scale broken on the other machined faces, it was found that some castings changed in shape very much. The author has measured barrels which were perfectly true as soon as they had cooled after removal from the boring machine, the bores of which distorted as much as two-hundredths of an inch out of parallel during the next twenty-four hours.

The set of jigs and the sequence of machining operations described properly safeguard the essential functions of the part. They automatically ensure a good even thickness of metal around the barrels, and that the whole of the machining of the casting is true to the final locating face when it is put to work. The marking-out operation has survived, although many attempts have been made to do away with it on a production which handled about 10,000 castings per annum. The percentage of absolute rejects from misplaced jacket-cores was probably not two castings per 1,000, but as the amount of metal removed from the inside of the barrel and the foot was great, no doubt many castings were saved and finished to the desired accuracy that would have been defective had other locating or "spotting points" been adopted.

This piece and its liability to distortion form most excellent instances of why departure from the rules laid down sometimes leads to disaster. Even the most innocent pieces may develop some unexpected irregularity. When once these rules are treated as axioms, it will be found that jigs locating from the correct place do not really cost more to make than those which work from some artificially-constructed "spotting point." If they do cost more than is justified by the saving they would bring about, they should be ruled out and not made, and the problem dealt with in another way.

The crank-case, which is also a complicated casting made with many cores, is likewise set up and marked out. The first operation, Fig. 6, is milling the seat for the cylinders; the second operation (Fig. 7) is straddle-milling for the plummer-blocks of the crank-shaft bearings and oil-base face, and is located from the first. This is one of the few cases where an apparent departure can be made from Rule 2. It will be observed that two straddle-mills are used to machine the outside edge of the case, and provide a face truly parallel to, and at a definite distance from, the centre of the crank-shaft. It is legitimate, because any possible inaccuracy is quite unimportant.

The casting is then mounted (Fig. 8) upon an angle-plate on a boring-machine in such a position that the axis of the crank-shaft and the cam-shaft are truly horizontal. There is no special feature about this jig except that it will be noticed the location is taken from the cylinder face and the previously-referred-to straddled edge. The cutter-bars are guided by hardened and ground bushes attached to the jig and driven through universally jointed shafts from the boring-spindle.

HISTORY OF THE CANADIAN LOCOMOTIVE COMPANY.

MORE than sixty years have passed since the first locomotive-building plant in Canada was established at Kingston, Ont. The works of the Canadian Locomotive Co., started in a small way in 1850, and have been operated up to the present with varying success, and under several different managements. They have passed through the many vicissitudes experienced by all large manufacturing concerns, until to-day they form an industry of recognized importance, with records of having built locomotives of every description for the different railroads in Canada.

CANADIAN LOCOMOTIVE PLANT, KINGSTON, ONT.

The works were established in 1854 by Messrs. Tutton & Duncan, and in 1865 were taken over by a company formed mostly of Montreal men, and known as the Canadian Engine and Machinery Co. In 1881 the Canadian Engine & Machinery Co. was re-organized, and, with the late Hon. Sir George Kirkpatrick, as president, and the Hon. Wm. Harty, of Kingston, as managing director, business was carried on most successfully till 1886, when the company passed into the hands of Dubs & Company, of Glasgow, Scotland. Fourteen years later, in 1900, the company was again re-organized, this time by the Hon. Wm. Harty, who was its first president. It then became known as "The Canadian Locomotive Company, Limited." The plant was improved by the installation of new equipment, new buildings were erected, and the output capacity increased.

It was at this time, when further additions to the plant were under consideration, that the success with which the company was operating, gained for it the attention of some well-known capitalists. In April, 1911, the works were visited by Aemilius Jarvis and some British associates, and, a short time after Aemilius Jarvis & Co., bankers, Toronto, made an offer of purchase, behind the offer being a proposal to form a new company with a greatly increased capitalization. The offer was considered by the shareholders at a meeting held on May 26, 1911, and was accepted.

As a result of these negotiations the company was reorganized under the name of "Canadian Locomotive Co., Ltd.," the capitalization was raised from $500,000 to $3,500,000, and a new directorate board was formed. Hon. Wm. Harty was made president of the new company, and the following directors were elected:—F. G. Wallace, Pittsburg, Pa.; Robert Hobson, Hamilton; W. Y. Sopher, Ottawa; Aemilius Jarvis, Toronto; James Redmond, Montreal, and J. L. Whiting, Kingston.

A progressive policy was immediately entered upon by the new officers. A large sum of money was set apart for the erection of additional buildings and for the purpose of new machinery and euipment, and A. W. Wheatley, of the American Locomotive Co., was engaged as general manager. Since this last reorganization, further changes have been made, Aemilius Jarvis being now president, and A. W. Wheatley, vice-president and general manager.

The progressive policy adopted by the new management has been productive of most encouraging results. The enlargement of the plant and the installation of new euipment has been such that at the end of 1914, the company was in a position to turn out 25 engines per month, or 300 engines per year. The plans for enlargement of the plant have been carefully prepared, and permit of considerable further additions.

Renfrew, Ont.—At the annual meeting of the Renfrew Board of Trade, W. E. Smallfield was re-elected to the office of president. H. W. Airth was elected secretary.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.—V.

By Albert A. Dowd.

UNDER this heading in our last issue in this section, the "Machining of a Spoked Type Farm Gas Engine Fly-wheel," was described and illustrated. Continuing the series of articles, the "Machining of a Plain Clutch Fly Wheel' 'is here featured.

Machining a Plain Clutch Flywheel.

The type of fly wheel shown in Fig. 4 at A is to be machined all over, and the tool layout for the first setting is shown in that illustration. As in the former instance, the external and internal surfaces must be so machined that they will be concentric with each other, in order that a proper balance may be maintained when the engine is running at a high rate of speed. Concentricity is also important on account of the clutch member which works against the large internal surface of the rim.

A set of special jaws B is used to hold the work by the inside of the rim, sufficient clearance being left at C to allow for undercutting in the first setting. The tool D in the standard tool holder E is used to rough bore the clutch surface and also to face the upper side of the rim, while the tool P in the side head turns the outside diameter. A reference to the illustration will make it clear that the amount of surface to be covered by

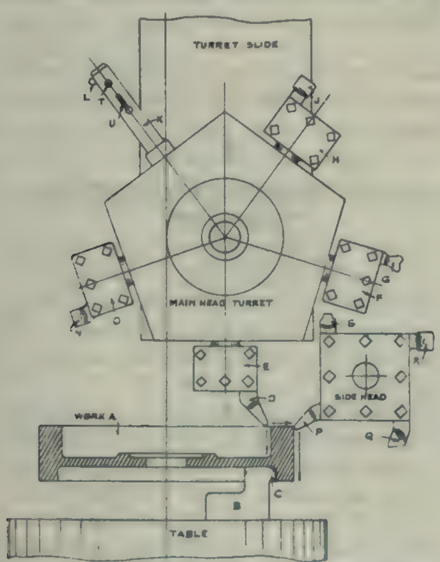


FIG. 4. TOOL LAYOUT FOR FIRST SETTING.

the tools D and P is about equal so that they will complete their work at approximately the same time. It should further be noted that as there is very little difference in the diameters on which the cutting action takes place, there will be very little loss of time due to incorrect speeding. Attention is called to the fact

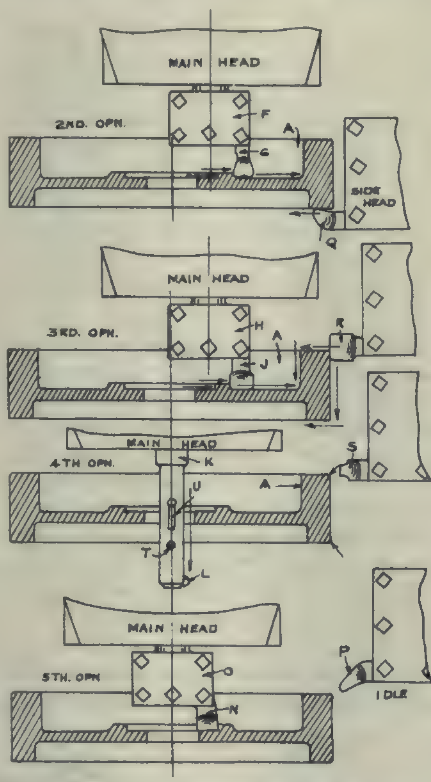


FIG. 5. TOOL LAYOUT FOR 2ND, 3RD, 4TH AND 5TH OPERATIONS.

that the only special tools required for this setting are of the forged variety and therefore the expense of tooling is very slight.

Fig. 5 shows the various positions of the tools for the 2nd, 3rd, 4th and 5th operations. The 2nd operation consists of roughing out the holder, facing the hub and rough-facing the web of the wheel with the special tool G in the regular tool holder F as indicated by the arrows in the illustration. While this operation is taking place with the main head, the side head tool Q is utilized to undercut the rim, and in this connection it should be noted that we have so constructed the jaws that they will allow this tool to pass the edge of the rim without interference.

In the third operation all the interior and exterior surfaces which have previously been roughed are finished by the tools J and R in the main and side heads. With the exception of the shouldered portion of the web all these surfaces are finished to size in this operation, a few thousandths being left on the shoulder for the final sizing cut.

The main head turret is now indexed, and the three cutter bar K brought into play. This bar contains a tool L at its lower end which is used for roughing out the hole. A short distance above this and set at right angles to the other cutter is the finished boring tool T, while still higher up is the flat floating reamer cutter U which sizes the hole. Immediately after the reaming cut has been finished, the side head tool F rounds the two corners of the rim. The final and fifth operation consists of sizing the shoulder with the tool N in the tool holder O. A noteworthy point in this arrangement for sizing is that the main head is brought to the centre stop and the tool so set in the holder that it will produce the correct diameter when in this position. Very accurate results can be obtained by this method of procedure and an expensive piloted sizing tool may be dispensed with.

The second setting of the work is of such a simple nature that it does not require illustration, the only point of importance being that the work is located on a fixture, from the shouldered portion. The machining is obvious.

FIXTURE FOR PLANING LINKS AND BLOCKS.

By G. Barrett.

THE planing of links is one of those jobs on which a great deal of time can be lost or saved, and therefore only a few are required to make the provision of a special fixture a desirable undertaking. In the accompanying illustrations is shown a fixture for planing the link A, Fig. 1, to a perfect radius. The plan of the arrangement as set up on the planer is shown in Fig. 2.

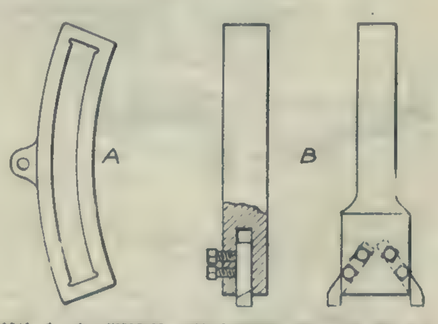


FIG 1 A—TYPE OF LINK TO BE PLANNED AND B ADJUSTABLE TOOL FOR THE PURPOSE.

The fastening of the work is accomplished by means of four set screws which are also used for locating it. The construction is well shown in Fig. 3.

The cast iron base plate A, is bolted to the planer table in such a position that its centre is in line with the centre of motion of the table about the point where the arm D is fastened to the bed. In the centre of the base plate is drilled and tapped a hole to take the pivot screw upon which the upper casting B swings.

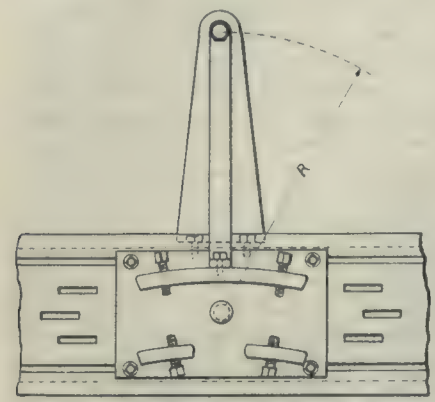


FIG. 2.—LINK PLANING DEVICE SHOWING SWINGING MECHANISM.

The bracket D may either be cast or be of angle iron, and may be made to take in links of different radii this radius being determined by the position of the cap screw C. The swinging of the upper casting B carrying the link is accomplished by an arm bolted to it, and swinging about C by means of a slotted hole. Care should be exercised in making the various parts heavy enough to provide the necessary stiffness, particular attention being given to the pivot screw. The swing bar in the present case was made of ¾ x 3 inch flat machine steel. With a little care in marking locating points, the fixture can be quickly set up and taken down, and the work carried out without any trial cuts.

The type of tool used is shown at B, Fig. 1. This is made in both roughing

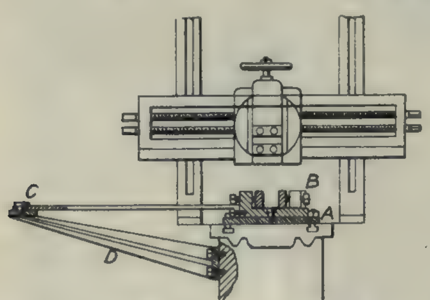


FIG. 3—LINK PLANING FIXTURE SHOWING METHOD OF CLAMPING AND ARRANGEMENT OF LEVERS.

and finishing sizes and can be readily adjusted by simply moving the tools forward or back. The link blocks can be readily planed in the same fixture by simply providing means for clamping the block in the centre of the upper or rocking plate. The hole in its centre greatly simplifies this operation.

A HOME-MADE DIE STOCK.

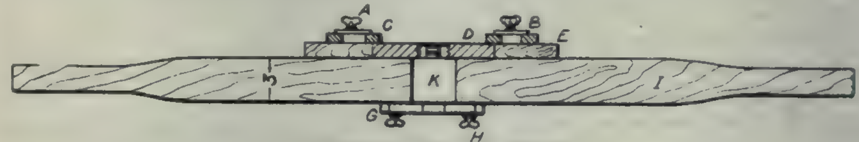
By J. E. Noble.

A considerable part of the writer's life has been spent in rural and outlying communities, chiefly in the selling, erection and repairing of machinery. Such an experience is productive of many interesting episodes and ingenious methods and devices are more common than in large plants well supplied with time and labor-saving apparatus.

The accompanying illustration is that of a die stock and is the enforced product of one of those plants whose owner considers every item of supplies other than coal as needless extravagance. The engineer, being up against it for a pipe threading tool and being neither convenient to where one could be bought nor being disposed to spend his meagre earnings in this way, developed the contrivance shown.

The stock proper I, is made of a piece of hickory nicely shaped and having a hole through its centre large enough to clear the largest sized pipe required to be cut. Two blocks E are strongly fastened with screws on either side of the hole and equally distant from it so as to take the die D snugly between them. The die is held down by the steel plates C and the thumb screws A which work in slotted holes to permit removal of the die.

The guide plates G are made of flat steel and are in the form of vee blocks



A HOME-MADE DIE STOCK.

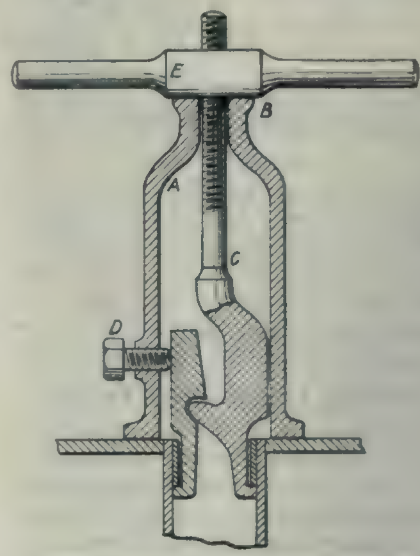
held in place by thumb screws working in slotted holes. In operation, the stock is slipped over the end of the pipe and is squared up with it by adjusting the plates G, after which as many threads as required can be made without readjustment.

The above device is not to be reckoned as possessing much real value in these times when tools are plentiful and fairly cheap. It did the work, however, and did it well, and may serve to set some engineer thinking along a line that will help him out of an equally difficult situation.

TOOL FOR DRAWING FERRULES FROM BOILER FLUES.

By Geo. Barrett.

THE illustration herewith shows a simple tool with a wide range of usefulness. It was made for the purpose of drawing ferrules from boiler flues, but a cursory examination will suggest many other uses for the appliance. The body A is a steel casting or may be forged. It is drilled out at B to take the pulling screw



FERRULE PULLING APPLIANCE

C which is forged to the shape shown and is screwed with a square thread.

The operation is self explanatory. The handle E is unscrewed to permit the dogs entering beyond the ferrule. The grip is made fast by screwing down the cap screw D. With a little judgment the apparatus can be made fairly light and the most refractory ferrule comes out by its aid very easily. The device can be improved for light work by putting a thumb screw in place of D and a spring around it between the loose dog and the frame.

ONTARIO WORKMEN'S COMPENSATION ACT.

UNDER Section 101 of the Ontario Workmen's Compensation Act, manufacturing groups are authorized to form protective associations in order to reduce risk of accident, and, consequently, their rates of assessment.

A general movement is now under way among manufactuerrs to take advantage of this clause. The first to form a protective association were the small electric power companies. The canners followed, and the quarrymen and meat packers have now incorporated their protective associations. Machinery builders, iron and steel fabricators and erectors, flour millers and others are in process of organization.

The idea of the Compensation Act is to charge just what compensation costs.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

TECHNICAL AND INDUSTRIAL EDUCATION.

By J. P. Sanderson.

THE national economic value of technical education is gradually but surely impressing itself upon our administrators, national, municipal and commercial, the basic principle being realized to an extent never before that if education enables a man to utilize and dispose of profitably his country's national resources as these may be available to him, the resultant general effect will be his desire to conserve and reproduce these resources by every means possible, and incidentally, whatever individual benefit be derived, there is reflected a more or less equivalent benefit to the great mass of citizens as a whole.

The firemen at the boilers has a much better opportunity of economizing fuel than the man who buys it. Again, the mechanic at the machine tool will be the first to observe short cuts in production which will eventually lower the cost of manufactured goods and thus make them more available to the general consumer. Until the comparatively recent educational movement, however, relatively few firemen understood, even in a rudimentary sense, the chemical processes of combustion, and the man building an engine or other mechanism could rarely explain the fundamental principles upon which his machine depended for its successful operation. The results of vocational training abroad, the wide dissemination of technical literature and periodicals and the rapid mechanicalization of our everyday life has developed a desire and a need of a better groundwork, education in natural science. In fact, rapid as has been the advance in technical education, our requirements in this line are growing at a still more rapid rate.

Technical schools may be said to have had their beginning in Great Britain through the night classes originated by Prof. Perry for the Civic Guilds of London. From these the day school branch of the technical school work has been gradually developed. The original British idea of a technical school has, however, been maintained, that is, a school for the purpose of imparting technical education to mechanics at times when they are not engaged in their regular occupation. Some of the larger British schools have as many thousands enrolled in the night classes as there are hundreds connected with the day schools, which would seem to indicate that the kind of teaching required by night students is not popular with those who are free to attend during the day.

In the United States the system seems to have originated in the technical high school, night schools being left largely to the Y. M. C. A. and similar institutions. The purpose of the technical high schools seems to be the provision of a high school in which applied science and vocational training is undertaken to the same extent as literary, historical and similar subjects are treated in the regular high schools. The education is thus more or less confined to students wishing to prepare themselves for positions of supervision in connection with trades or manufacturing plants, or to those who are too young to take up the learning of a trade in the usual way.

In Canada are to be seen the best efforts to reach the greatest number of needy students. Night school courses in vocational subjects are, as a rule, planned to be of direct assistance to the student in his daily work, the teachers being men from the ranks, who are best fitted to cater to the requirements of the ambitious mechanic. The day classes on the other hand, furnish to the boy who is planning a mechanical career the necessary mathematics and technical training that cannot be obtained at the regular grade or high schools.

There was a pronounced tendency in the earlier technical schools—still existent in numerous instances, to employ men of very high scientific and technical standing as teachers. The result, however, has generally been that the work in the vocational branches gradually gets out of the sphere of the shop men who need it, most of whom probably had to leave school in order to earn a living. Attempts have even been made by some to furnish a professional rather than a vocational education, but this cannot supply the greatest need and must necessarily fail in its ultimate purpose. The financial stringency, while interfering with the building of new schools, is increasing the student interest in those already at work and there is, therefore, all the more necessity for the strict adherence to a practical curriculum.

While there have been no large new schools, established during the year just passed, business stagnation, war and similar causes may be rightfully ascribed as the deterring agents, several undertakings which had been planned throughout the West having been postponed. On the other hand, several very large institutions, notably the new Toronto technical school, have proceeded apace and this will shortly be ready for occupancy. In the matter of technical education and the establishment of technical schools in Canada, considerable progress has been made in the cities of Medicine Hat and Lethbridge while the city of Calgary has extensive plans in these directions. The city of Winnipeg has two technical schools both of which are well patronized while that of Vancouver, though not the largest in scope is perhaps the pioneer institution of the West.

The results of the work of technical schools are not long in following the establishment of the schools themselves. The banner manufacturing Province of Ontario has long contributed the most towards technical education and the recent rapid growth of manufacturing industries in Quebec Province was preceded by the founding of technical schools in the cities of Quebec and Montreal. The popularity of and profit to be derived from technical education are indicative of our desire for greater industrial development and that the latter will be realized in full measure in the coming days, we have every confidence.

REDUCING CONSUMPTION OF COTTON WASTE.

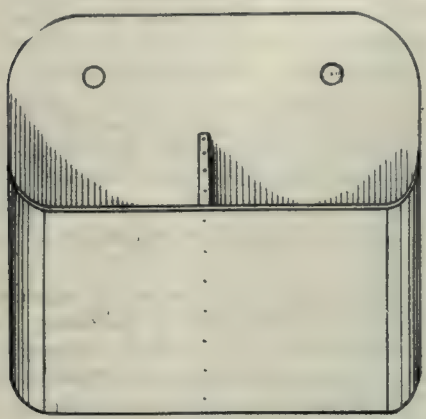
By P. W. Blair.

THE cutting down of the monthly consumption of cotton waste has received considerable attention from the officials of a leading western Ontario plant engaged in the manufacture of iron and brass goods. Several plans have been tried in succession with varying results, the following one being finally adopted as the most easily put into operation.

The working value of any cotton waste depends upon its length of life, cleanliness and absorbant qualities of the thread stock from which it is made. For this reason, a low priced waste of inferior quality is, in the long run expensive. Besides, there is no possibility of washing such waste even if the plant be equipped to do the work. It is often said, on the other hand, that the higher priced waste receives no better care than the poorest grades and the advantage of quality is therefore lost, in the average factory.

Waste is used in so many places and for so many purposes about a shop that the proper adherence to the fire underwriters' regulations is difficult in any case. The plant in question surmounted all these difficulties by distributing an allowance of the material to each bench and machine twice a week. This work was done by the caretaker who also collects the dirty waste and sees that the receptacles are not used for any other purpose.

To each machine is attached a sheet metal pocket for the reception of waste.



CONVENIENT METAL WASTE RECEPTACLE.

This is placed somewhere within easy reach of the operator and is arranged to hold both fresh and cleaned waste as shown in the sketch. Similar pockets are provided for the benches and thus a definite place is made for every piece of waste that has any right to be in the factory. There is now no waste stowed away in workman's tool boxes or scattered around on the floor or under benches, and inspectors of the fire underwriters have heartily endorsed the system.

The consumption of waste has been reduced about forty per cent. and incidentally, the appearance of the shop has been very materially improved. It has been found also that little, if any work has been added to the duties of the caretaker as the elimination of the waste nuisance has lightened his work in other directions.

NEW PROCESS FOR PRODUCING GASOLINE.

THE discovery is announced by the United States Bureau of Mines of two chemical processes, one of which it is claimed will be of tremendous importance to the oil industry, greatly increasing the supply of gasoline, while the other may make the United States independent of Germany and other nations for supplies of materials necessary for the dye industry and the manufacture of high explosives used in warfare. The first of these processes promises to enable the independent refiners to increase their output of gasoline from petroleum 200 per cent. or more. With an estimated production on the part of the independent refiners of 12,000,000 barrels of gasoline in a year, this will mean an output from independents alone of 36,000,000 barrels, being greater than the total production to-day from all sources. The second process includes the manufacture from crude petroleum of what is known chemically as toluol and benzol, both of which have been heretofore obtained from coal tar.

The discoverer of these two valuable processes after many years of research is Dr. Walter F. Rittman, chemical engineer of the Bureau of Mines, the work having been done at Columbia University, New York, the facilities of the laboratory there having been turned over to the Federal Government by President Cutler.

PERCENTAGE OF EYE ACCIDENTS HIGH.

IN a recent report of the Industrial Commission of Wisconsin, it is shown that over 70 per cent. of all the injuries to workmen caused by chips, nails and other small objects affect the eyes. Out of a total of 346 cases reported, 32 men lost the sight of one of their eyes entirely, 217 had eyes injured, 75 suffered from lacerations, 7 from impaired sight and 15 from bruises. The causes of the above injuries were as follows: 283 were hit by chips, 14 by nails, 4 by stone from blasts, 3 by bursting water-glasses and 42 by other small objects.

The Commissioner further states that of the 70 per cent. it is safe to say that fully three-fourths of these eye injuries could be avoided by the wearing of goggles and in fact, within the past year, many Wisconsin plants have adopted the use of goggles and as a result eye injuries have been almost entirely eliminated.

THE CONDUCT OF LIFE.

A topic of considerable interest recently discussed in the press, says G. W. Buckthought, in the Great Eastern Railway Magazine, is that of the cause of the conspicuous dearth in these days of great men. Educational methods may largely be responsible, but the root of the whole trouble, one thinks, is the current theory in regard to the proper conduct of life. Lord Haldane in his inaugural address as honorary president of the Associated Societies of Edinburgh, Scotland, gave utterance, we think, to some very sound principles of life and conduct. His views are worthy of the widest circulation, and the following notes cannot fail to hearten, enlighten and guide all who read and inwardly digest them:—

Each man must shape his own destiny, and work out his own salvation.

Beware of morbid concentration on your own private concerns.

We are all subject to reverses. Provide against the depression which they bring in their train by acquiring the large outlook which shows they are not the most important things in life. The only foundation of what is abiding is the sense of the reality of what is spiritual—the constant presence of the immanent Deity.

Devote your highest energies to attaining to the largest and widest view of life. It will come to you and bring you all its sustaining power, if you strive hard enough. Christianity, philosophy, are media for the revelation that the ideal and the real are but different aspects of a single reality.

Accept what comes to you undisturbed. A man is stronger as well as better and has more power of influencing circumstances as well as other people, if he resolutely accepts without complaint what comes to him, remembers the duties of his station in life, and thinks of others as much as of himself.

"Live like a hermit and work like a horse." That was Lord Eldon's motto for success. That rule of practice is indispensable whatever career one chooses. Lay the foundation of wide knowledge and catholic interests. Literature, philosophy, religion, science, music, the fine arts are all widening interests. Think greatly and widely.

In the highest order of work, no one man can know or do everything himself, and the great man of affairs always knows how and what to delegate. The strength of Cromwell, Napoleon and Bismarck lay in their grasp of great principles and their resoluteness in carrying them into execution.

All great men have been under the domination of beliefs which rested on the foundation of principle, and they were inspired to the extent that their beliefs were suffused with passion.

James DeVon, 227 Davenport road, Toronto, representative of the Thwing Instrument Co., Philadelphia, reports having recently sold several indicating and recording pyrometers to Canadian plants.

Hamilton, Ont.—It is stated that the National Steel Car Co., have received a contract from the French Government for a number of railway cars. The company are also making field kitchens for the British Government.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW HEAVY PLAIN AND UNIVERSAL MILLING MACHINE.

IN designing the larger sizes of Ohio milling machines, care has been taken to obviate shifting a heavy belt by hand, returning the table after a cut, or making long adjustments by hand, and as far as possible all other hindrances to operation efficiency.

The patent belt shifter now applied to these millers protects the operator from bodily injury, but also approaches the advantages of the single pulley type of machine by reason of instantaneous speed control. One turn of the handwheel on the machine shifts the belt from one to the next cone step, and the lever above instantly places it in the desired position on the countershaft cone. Since the power of shifting is applied extremely close to the pulley, a very tight or heavy belt yields instantly.

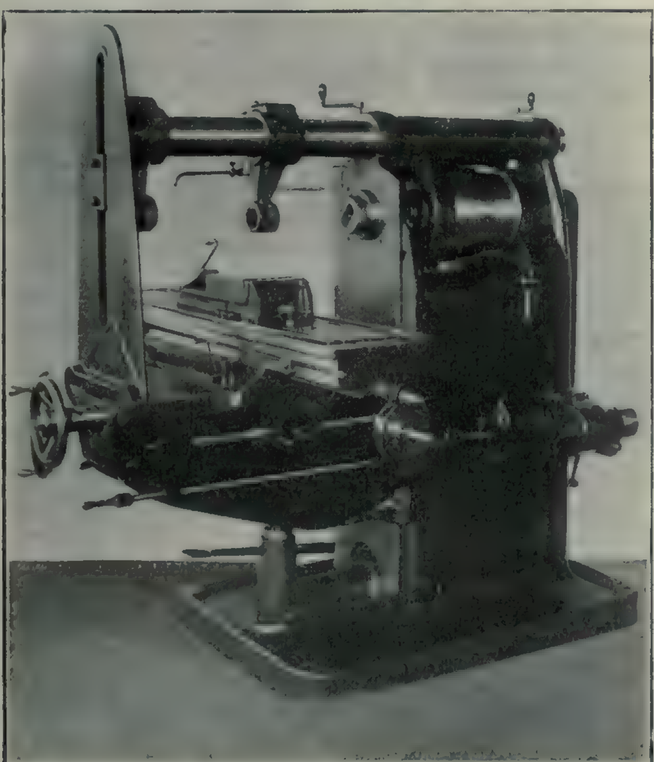
A prominent labor-saving device is to be noted in the arrangement for quick power movements of knee, saddle and table. It consists merely of a fleeting motion for whatever feed may be engaged, and is operated by depressing the treadle at either side of the machine base. These treadles are connected by means of levers and shafts to a fork which operates a clutch at the rear. This clutch is normally engaged with a gear driven from the feed box, and when shifted by means of the treadle becomes engaged with the quick speed from the counter or line shaft. Upon releasing the treadle, it automatically re-engages the adjusted feed box speed. A safety stop is provided at the limits of all movements.

Attention may be directed to the rigid construction of parts usually subject to vibration. The column, knee and table are all 13½ inches wide, which liberal proportions serve to illustrate their massiveness. The column and base are cast in one piece, with an unusually heavy front wall forming the slide for knee and the main support for spindle. The knee bearing on this slide is extended 5½ inches above top of knee, reinforcing the column at the point of greatest strain and affording a long vertical guide. This insures not only rigidity, but also an accurate vertical movement. There are no recesses nor large openings in the sides of the knee, and the top is solid front and back, being reinforced by a heavy box web less than 3 inches below centre opening, which is only length of feed plus nut, and is spanned entirely by saddle when directly over the opening. This construction permits of placing the cross screw in line with the centre of spindle.

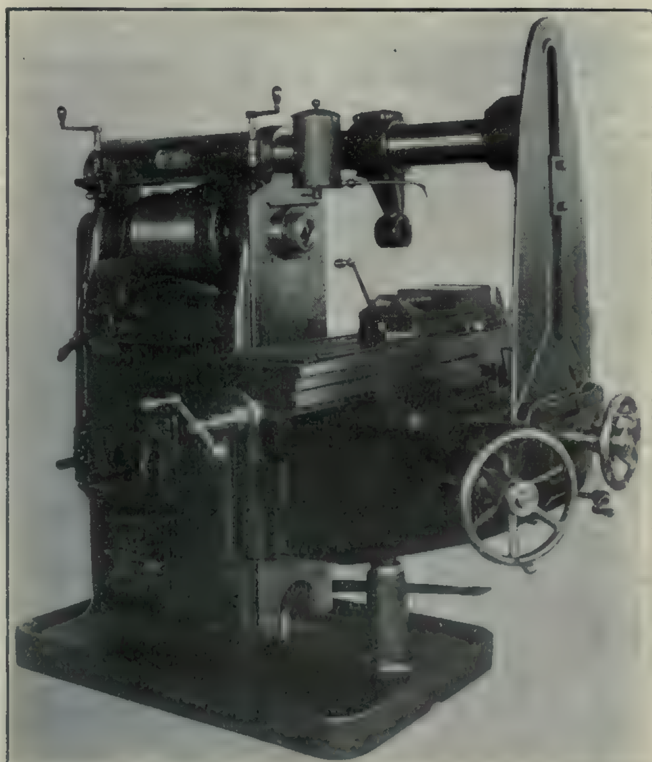
The machines give token of being powerful, a feature in this direction being the unusually large cone which affords a high belt velocity, the smallest step being 10¼ inches in diameter. To back the power, the spindle is arranged with positive drive for arbor by means of an interlocking recess and flat. It is made of a special spindle steel, runs in bronze bearings lubricated from oil wells in the column, and is adjustable for wear. The double back gears are eccentrically mounted on inside of column below the spindle, and are claimed to run noiseless under all conditions.

The feed is transmitted from spindle by roller chain to the feed box, where all changes are controlled. Only four of the sixteen rates of feed leave the box running faster than the spindle, the twelve others reducing below spindle speed. From the feed box the feed is transmitted through a universal joint and telescopic shaft to a tumbler in the knee, provided for the purpose of reversing all feeds, and from there is distributed to the table, saddle and elevating screws.

Attention is called to the manner in which power is delivered to the lead



NEW HEAVY PLAIN AND UNIVERSAL MILLING MACHINE.



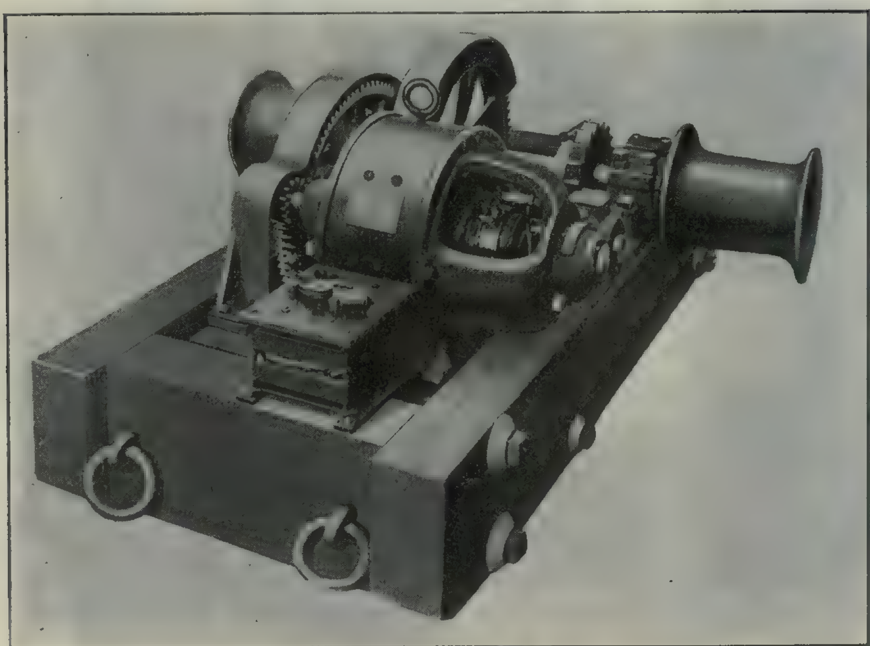
NEW HEAVY PLAIN AND UNIVERSAL MILLING MACHINE.

screw so as to avoid all torsional and radial strain. The driving gear is mounted to float upon a hardened and ground steel sleeve through which the screw passes, and is clutched into another sleeve mounted and keyed upon the screw immediately aside the lead screw nut. All control levers are centralized most conveniently for the operator.

All cutters and tools, attachments, arbors, chucks, etc., etc., are interchangeable on the No. 34 heavy plain and universal and No. 42 plain and universal Ohio machines. The plain and universal machines are identical except for the swivelling saddle. The Oesterlein Machine Co., Cincinnati, Ohio, are the manufacturers of these products.

A PORTABLE WINCH.

THE construction of the New York Subway necessitated the building of the portable motor-driven winch shown in the accompanying illustration. It has, however, since demonstrated its usefulness in many other fields. When used for lifting material out of the subway a trestle or light frame work carrying a sheave is placed directly over the opening. The hoisting rope is passed over the sheave, given two or three turns around the friction drum, the motor started and the slack paid off as the material is hoisted. When used to assist teams in hauling loads up heavy grades, one end of the rope is fastened to the wagon tongue and the other end given several turns around the friction drum. Current is obtained from the 550-volt trolley circuit.



A PORTABLE WINCH.

The winch is manufactured in two sizes by the Dobbie Foundry & Machine Co., Niagara Falls, N.Y., the smaller outfit operating at a rope speed of 152, and the larger one at 178 feet per minute. Westinghouse Electric compound-wound type S.K. motors of 5 and 7½ h.p. respectively supply the motive power, and are very light, compact and easily portable.

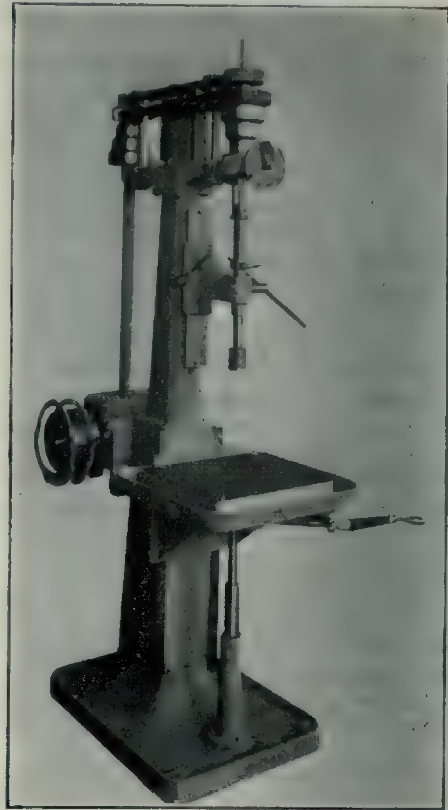
QUICK CHANGE SPEED SENSITIVE DRILL PRESS.

THIS quick change speed sensitive drill press, when equipped with an automatic chuck, is designed so that all speed changes and changing drills of various sizes can be made without stopping the machine. The operator, it is claimed, has no excuse to leave his natural working position, either for changing speeds or drills, raising or lowering the table, or throwing the power on or off.

These machines are built in various combinations, of from one to eight spindles, inclusive. All speed changes can be made instantly. The machines have four speed changes arranged for either carbon or high-speed drills, the dial showing revolutions per minute being attached to the head in plain view, the operator simply swinging lever to the number of revolutions wanted. If desired, dials can be arranged to show the size of drill instead of the revolutions per minute. Power and speed variations are sufficient to handle high-speed drills from the smallest up to 29-32-inch diameter.

The spindle is made of a high-grade steel, accurately ground, and is provided with thrust ball bearings. It has a special effective oiling feature, and a stop collar is provided and can be set for any given depth. The spindle driving cone pulley runs on ball bearings.

One idler is fixed while the other which is held in the swinging arm, is



QUICK CHANGE SPEED SENSITIVE DRILL PRESS.

pressed by a light spring against the slack side of the belt. This pressure is sufficient to make the belt pull efficiently under drilling resistance, and automatically take up any stretch that develops through continued use. The ball bearings are high grade, and where required, a bearing with a four point contract is employed.

The table is of rigid construction, well stiffened and has an oil grove of ample capacity. Chips are easily removed, and there is wearing surface of ample length on base. The telescopic screw adds extra support under drill pressure and avoids boring any hole in the floor. A gib locks table rigidly to base. The position of crank handle enables the table to be raised or lowered, while the operator remains in his natural position.

These drill presses are designed and manufactured by the Sipp Machine Co., Paterson, N. Y.,

The Turbine Equipment Co., Toronto, have sold to the Swedish General Electric Co., for the Standard Chemical Co., Longford, Ont., one 3½-million-gallon De Laval single stage double suction centrifugal pump, to operate against 125 ft. total head. This pump will be direct connected to a Swedish General Electric motor.

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Vol. XIII. MARCH 11, 1915 No. 10

PRINCIPAL CONTENTS.

U.S. EXPORTATION OF ARMS AND MUNITIONS OF WAR.

WHATEVER other opinion all or any of the belligerent nations may hold as to the determination of the United States Government to refrain from participation in hostilities, it is abundantly evident that there is absolutely no ground for the claims of Germany that our neighbors are differentiating in the matter of supplies to the detriment of that country in its warfare against the Allies. Through its Government we believe the United States to be giving a square deal to all of the warring nations, even in spite of the fact that its sympathies cradled and expressed are towards ourselves.

The United States, however, in its multitudinous business and manufacturing activities does not now any more than in former times concern itself about delivery, beyond that expressed by F.O.B. It has not in recent years tried very seriously to combine ocean transportation of its products with that of their manufacture, but rightly or wrongly has left the carrying feature to the care of the buyer or somebody acting for the latter in that capacity. Germany, like most of the other European nations, has all along been cognizant of such conditions existing, and, in her wisdom shall we say, provided German bottoms to transport her own as well as the requirements of others.

So far as the United States is concerned, conditions have not changed, except it be that on account of the now long-time prevailing business depression she is more than ever willing to manufacture and dispose of her wares. Getting necessities—food and munitions of war to the Fatherland is not, however, the picnic it used to be. There are lions in the way and to cage these the United States is beseeched, or, failing that, to at least quit feeding them.

Much loose talk was indulged in during the early weeks of the war relative to the shrewdness and business capacity of the German people, even to the extent of crediting Kaiser William as being the genesis and embodiment of these attributes. Without in any way attempting to flatter America's business men and certainly with no idea of trying to detract from the much lauded sagacity of the Teuton, it may confidently be asserted that the latter have at no time been in the same class as the former, and while in normal times the gulf distinguishing the one from the other was on superficial observation perhaps less apparent, there is to-day unmistakable evidence as to who is and of course always was "top-dog."

The difficulty that Germany experiences in getting supplies from the United States is a real one, and we doubt not that her complaint on account of the difficulty is equally real. She took at least a sporting chance of winning by embarking on this war, but she gives abundant evidence that she lacks the sporting spirit of a good loser, and no better exemplification of her misrepresented shrewdness and unbalanced business capacity is to be found than when in the face of the silent economic pressure exerted by the naval and military forces of the Allies, she begins to whine.

The clean-up now being prepared for and concurrently brought measurably nearer is much too comprehensive however in its scope to be arrested by any species of complaint. Arms and munitions of war are to be had ad lib. in the United States by any of the belligerents, and their orders will, we are sure, continue to be received with open arms. Bearing them home, however, touches each purchaser individually and is no affair of the seller.

INSTEAD of turning swords into plow-shares, the Germans are melting church bells to make cartridges. Needless to add, they are stealing the bells.

• • •

GERMANY need not plead the "Baby Act" because her navy cannot compete with or is at least afraid to meet that of Great Britain in a straight up and down tussle.

• • •

IT is a perilous business—this ready condemnation of other people, and invariably indicates tactlessness, stupidity and gross ignorance. In its own little world, it however betokens smartness.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	22 00	19 00
Victoria, No. 2X	22 00	19 00
Victoria, No. 2 Plain..	22 00	19 00
Hamilton, No. 1.......	20 00	19 00
Hamilton, No. 2.......	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.10
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.10
Beams and angles, Pittsburgh ...	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 9 50	$10 00
Copper, crucible	11 00	11 50
Copper, unch-bled, heavy	11 00	11 50
Copper, wire, unch-bled.	11 00	11 50
No. 1 machine compos'n	9 50	10 00
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 00	9 50
No. 1 brass turnings....	7 00	7 25
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Feb. 13, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	64	49	....	....
½in.	69	58	....	....
¾ to 1½ in. ..	74	63	....	....
2 in.	74	63	70	59
2½ to 4 in. ..	74	63	73	62
4½, 5, 6 in. ..	....	....	72	62
7, 8, 10 in. ...	....	....	68	57
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in. ..	68	57	....	....
2, 2½, 3 in. ..	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in. ..	....	....	67	57
4½, 5, 6 in. ..	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2in.	44	34	....	....
2½ to 4 in. ..	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	43	....	....
½ in.	63	52	....	....
¾ to 1½ in. ..	68	57	....	....
2 in.	68	57	64	53
2½, 3 in.	68	57	67	57
3½, 4 in.	....	....	67	57
4½, 5, 6 in. ..	....	....	65	55
7, 8 in.	....	....	61	50

Wrought Nipples	
4 in. and under	72½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in. ..	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in. ..	70%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake Copper, carload ..	$16 50	$16 50
Electrolytic copper	16 15	16 25
Castings copper	16 00	16 00
Tin	54 00	50 00
Spelter	12 00	12 00
Lead	5 25	5 75
Antimony	21 00	21 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$20 00
Openhearth billets, Pittsburgh.	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh..........	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 20
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16............	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes ..	4¼c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 100-lb. kegs, per cwt	6.75
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.71
Linseed oil, boiled, single bbls.	0.74
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch	$8.00
5/16 inch	5.35
⅜ inch	4.60
7/16 inch	4.30
½ inch	4.05
9/16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	35 & 5%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 80	$2 80
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 00	4 05
Apollo brand, 10¾ oz. (galvanized)	4 10	4 00
Queen's Head, 28 B.W.G.	4 50	4 45
Fleur-de-Lis, 28 B.W.G.	4 20	4 35
Gorbal's Best, No. 28	4 50	4 55
Viking metal, No. 28	4 00	4 10

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., March 8, 1915.—The past week has witnessed several events of interest to machinery manufacturers in general. Business, however, has been very much as usual, although on every hand there is a decidedly improved outlook. In the death of Andrew J. Darling, a member of the well-known engineering firm of Darling Bros., Montreal loses one of its pioneer manufacturers, Mussens, Ltd., on Friday last placed their business in the hands of a liquidator, but it is understood that the assets on the books exceed the liabilities by about a quarter of a million dollars. These assets are made up largely of a huge stock of machinery.

The Steel Market.

Canadian mills are not suffering greatly from the lack of orders. The Dominion Steel & Coal Co. have large European contracts to fill, while the Nova Scotia Steel & Coal Co. have large shell contracts. The Algoma Steel Corporation have closed further orders with American railways. The latest order was placed by the Illinois Central Railway and is reported to be in the neighborhood of 25,000 tons.

With regard to structural steel, little can be said, as business continues very quiet. In tin plate, wire products and steel pipe, conditions are rather better, but in merchant mill products the mar-

ket is only fair. Were the railways to loosen up and permanent investment be resumed, the total business would be far from unsatisfactory. However, inquiries are coming in regularly and in increased volume.

Pig Iron.

Pig iron markets are as usual very quiet, there being little or no business passing. In spite of the existing depression, however, the February figures of the Dominion Steel & Coal Co. show that their pig iron production has materially increased.

Machine Tools.

Business remains very quiet in machine tools, and conditions from week to week seem to change little. The fact that Mussens, Ltd., have placed their affairs in the hands of the liquidator caused, of course, a great deal of surprise, but as their books show assets largely in excess of liabilities, the position of the firm may be regarded as financially sound.

The supply business continues to be of considerable importance, being quite a large factor in the operations of several houses.

Metals.

The copper situation has not changed a great deal during the week. There was recently shipped from Baltimore on two steamers the largest single consignment of copper that ever went from America to Europe. The shipment consisted of 15,080,000 lb., and was destined for Havre, France. Prices are fairly firm.

The price of tin is up ten cents a lb. Spot tin is almost unobtainable and no relief is in sight until advices are received of definite shipments from London. The unsettled condition of ocean shipping is largely responsible for the increased price.

Spelter is also up one cent a pound. Briefly stated, the spelter situation is as follows: Prices higher, early deliveries scarcer than ever.

The lead situation can be summed up as follows: Quiet but firm. A slight advance in the price is reported and sales are about normal.

Antimony took another jump up of one cent a pound. There is no relief in sight.

Aluminum prices are the same and no changes are reported, although a fair amount of business is passing.

Toronto, Ont., March 9, 1915.—There is a somewhat improved tone in business circles this week and a more optimistic spirit is prevalent. Industrial conditions, however, are considerably under normal, but with the approach of spring the outlook will tend to improve. Further orders for military equipment and supplies continue to be placed and consequently a number of factories have plenty of work on hand. The stir caused by the new tariff is subsiding and conditions are being gradually adjusted. Prices of some lines have yet to be revised, principally on Canadian-made products; imported goods in nearly all cases having already advanced.

Steel Market.

There is no appreciable change in the condition of the iron and steel trade. Ordinary business is dull but the demand for steel for shells is active and the plants making forgings are busy. The building trade is quiet, and indications do not point to any material improvement for some time. The Algoma Steel Company has been successful recently in obtaining some interesting orders for rails from American railroads. Although the price is understood to be low, the industry will be stimulated and the mills kept in operation. There have been no price changes this week. Quotations have stiffened on Pittsburgh bars and shapes, but shipments are still being made at $1.10 base. Prices, however, covering shipments after April 1, have advanced 2½ to 5c per 100 pounds. There have been no further changes in domestic products since last week.

Pig Iron.

The market is dull and without interest. The advance in prices has had a tendency to further depress business.

Machine Tools.

Machine tool dealers here have been busy this week preparing their tenders for tools and equipment for the new Technical School. There has been less activity as regards shell-making machinery, as many firms working on shell contracts have placed their orders. Difficulty is being experienced in some cases in obtaining satisfactory deliveries as the makers of these special machines, especially those located in the States, are also working on large orders from Europe for similar tools. When orders for lyddite and the larger calibre shells are distributed there will be further activity in the trade as the equipment for these varies in some respects from that required for the 15 and 18-pound shell.

Supplies.

The demand for machine shop supplies is showing some improvement. There has been no further change in prices except in Manila and transmission ropes which have advanced ½c per pound. An advance in the price of brass goods is confidently expected while leather belting may also go up.

Old Material.

The market is dull and volume of business continues light. Copper and brass scrap have advanced again, quotations being ½c per pound higher. The new prices are as follows: Crucible copper, heavy and wire, 11½c per pound; brass clippings, 9½c, and scrap zinc 7c per pound.

Metals.

Although business has improved during the week it is still under normal. All markets are very firm, due entirely to strength in London. This is reflected principally in tin, which has jumped up 6c per pound, while spelter and antimony have also advanced ¾c and ½c per pound respectively. Other prices are unchanged.

Tin is strong in London and the market continues excited over the shipping situation at that port. Tin is quoted locally at 50c per pound.

Copper is firm and there is no change in the export situation. Lake copper is being quoted at 16½c per pound.

Spelter has advanced ¾c per pound. There is no change in the spelter situation and supplies are difficult to obtain. The price is unprecedented and indications point to still higher figures. Present quotation is 12c per pound.

Lead is firm at 5¾c per pound. Antimony is strong at an advance of ½c, being now quoted at 21c per pound. Aluminum is unchanged at 23½c per pound.

MUSSENS LIMITED IN LIQUIDATION.

MUSSENS LIMITED, dealers in railway, mining and contractors' supplies, were on Friday last placed in liquidation on petition of W. H. C. Mussen, the step being taken as a direct result of the depression recently experienced in this particular line of business. The liabilities are in the neighborhood of $300,000, and the assets, comprising merchandise on hand, realty holdings in Montreal and Winnipeg, open accounts, bills receivable, are stated by Mr. Mussen to be in the neighborhood of $550,000, or approximately $250,000 in excess of the liabilities. It is understood that an endeavor will be made on behalf of the creditors to have the business continued under the direction of the liquidator to be appointed. John J. Robson has been named provisional liquidator, until such time as the creditors hold a meeting and determine upon the nomination of the liquidator.

"The whole trouble," Mr. Mussen is reported as saying, "has been brought about by the difficulty experienced in getting in collections and in reducing the rather heavy stock on hand. In this particular we have simply fallen victims to the depression which has been met with in our particular line of business.

However, if the matter is properly handled, there need be no fear at all for the creditors. We have in book assets a surplus over liabilities of about a quarter of a million dollars.

"The stock which we carry is not of the kind that can be thrown upon the market broadcast, at any time—like, for instance, groceries, dry goods, etc. Even under normal business conditions our slack months are November, December, January and February, when heavy construction work is practically at a standstill. It is just at the present time of the year, under normal conditions, that our business begins to look up. Though the present is a rather abnormal time, our business has, as a matter of fact, shown a disposition to improve to an appreciable extent, and we have already received many inquiries regarding supplies, and have booked quite a few orders for delivery later in the season."

On the question of reorganization, Mr. Mussen, it appears is against such a proposal, unless it were one under which all the creditors would receive 100 cents on the dollar.

BRITISH IMPORTS FROM CANADA.

BRITISH trade returns for the year 1914, including five months of the war, received by the Department of Trade and Commerce, show that in spite of abnormal conditions there was a considerable increase in Canada's exports to Great Britain as compared with 1913. For the full year, Canadian produce sent to Great Britain was $4,652,000 greater than in 1913, and $22,690,000 greater than in 1912. For the final quarter of last year, the British imports from Canada were approximately nine and one-half millions in excess of those of the last quarter of 1913, principally due to the large trade in foodstuffs and other supplies bought from Canada consequent upon the war.

British exports to Canada, however show a marked decline, especially during the last half of the year. The decrease for the six months in comparison with the corresponding period of 1913 was $20,168,000. For the full year, Canada's purchases from Great Britain were $32,654,000 less than in 1913.

The increase in purchases from Canada last year are the more important when it is borne in mind that Great Britain's total imports from British possessions last year were about $17,200,000 less than in 1913.

Redcliff, Alta.—The Ornamental Ironworks and the Redcliff Rolling Mills have started operations after being closed some time.

The Turbine Equipment Co., Toronto, have received an order from the Cobalt Reduction Co., Cobalt, Ont., for two 1 million-gallon De Laval electrically driven centrifugal pumps, each to operate against 75 lbs. pressure. They have also sold 1 special De Laval 6-in. motor driven stock pump to the J. R. Booth Co., Ottawa.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Waterloo, Ont.—A new heating system will be installed in the Central school.

Owen Sound, Ont.—Wm. Kennedy & Sons Co., have received a contract for 25,000 shrapnel shells.

Walkerville, Ont.—Fire at the Canadian Bridge Co. plant on March 4, did damage to the extent of about $1,000.

Port Colborne, Ont.—It is announced that the Canadian Furnace Co., may blow in their furnace sometime this month.

St. Thomas, Ont.—W. H. Heard, of the Spramotor Works, at London, has purchased a controlling interest in the C. Norsworthy Co., known as the Red Foundry.

The Pas, Man.—The estimated cost of the lighting and heating plant of The Pas terminals of the Hudson Bay Railway is $35,000. The plans for the heating and lighting plant were drawn by W. E. Cox, of Winnipeg.

London, Ont.—General Manager Glaubitz of the Utilities Commission, who resigns his official position on May 1, has about completed the organization of a factory for the manufacture of electrical supplies. It is stated that the new factory will at the outset employ 100 hands.

Grimsby, Ont.—A permit has been issued to the Imperial Oil Co., of Toronto, to erect two large steel oil tanks, a pump house and a pipe line on the G. T. R. property on Robinson street, north, on the south side of the G. T. R. tracks. The pipe line will be two hundred and fifty feet long.

Winnipeg, Man.—A large contract for shrapnel shells, to be made in Winnipeg, was closed a few days ago. The work will be divided among the following firms:—The Manitoba Bridge & Iron Works, Dominion Bridge Co., Vulcan Iron Works, Western Steel & Iron Works, and the machine shops of the C. P. R., C. N. R. and G. T. P.

Guelph, Ont.—Another new industry has been secured for this city. The name of the new concern is the George B. Jackson Co. It has a large factory in operation at Westminster, Maryland, manufacturing all sorts of railway signals, torpedoes and fuses, and has been doing a large business in all parts of Canada. The new 7½ per cent. duty which has just been put on these goods by the Dominion Government, however, interferes with the Canadian business, and the company have decided to manufacture in Canada, selecting Guelph as its location. It is taking over the factory on Alice Street, formerly used as an axle factory, and later as a brass foundry, and will make alterations to suit its requirements.

Electrical

Delaware, Ont.—Hydro current was inaugurated here on Feb. 27.

Newmarket, Ont.—Equipment will be required for extensions to the street lighting system.

London, Ont.—The town council are in the market for electrical transmission equipment to cost $62,000.

Sandwich, Ont. —The Provincial Hydro-Electric Commission will install a street lighting system here.

Toronto, Ont.—The Toronto Hydro-Electric Commission propose to substitute 1,000-watt hydrogen lamps for the present cluster lamps in the downtown district.

St. Mary's, Ont.—It is proposed to install a new street lighting system and the necessary equipment, such as transformers, meters, wire, poles, etc., will be required.

St. Thomas, Ont.—The village of Dutton has carried by large majorities by-laws authorizing a contract with the Hydro-electric Power Commission for a supply of power, and endorsing an expenditure of $10,000 for the inauguration of the system.

Walkerton, Ont.—The Formosa Electric Light Co., has been formed and purposes running a line to connect with the Walkerton Light Co. wires at Mildmay. The sum of $5,000 has been subscribed and the following officers appointed: President, F. A. Heinz; secretary-treasurer, G. G. Benninger; directors, F. McCue, A. Opperman, J. H. Shefler.

Municipal

Saskatoon, Sask.—A water meter will probably be purchased by the city in connection with the water supply to Sutherland village.

Moncton, N.B.—The city council will purchase a number of water meters. J. Edington is city engineer.

Beverley, Alta.—The town council contemplate installing a waterworks and electric lighting system. The cost is estimated at $75,000. H. E. Read, engineer.

Edmonton, Alta.—A by-law submitted to the ratepayers authorizing the expenditure of $36,000 to take over the Viking gas well was defeated by a majority of over 3 to 1.

Lindsay, Ont.—The ratepayers on March 2, declared against rendering any assistance to the Canadian Boving Co., by way of guaranteeing bonds to the extent of $30,000.

Stratford, Ont.—The ratepayers on March 5 voted 2 to 1 in favor of the construction of a new main sewer at a cost of $72,000, as ordered by the Provincial Board of Health.

Kingston, Ont.—The city council has adopted the report of the Board of Works for reorganization of the city engineer's department. The engineer was reappointed, but the staff was reduced.

Toronto, Ont.—Work on the new Ransom filter plant at the Island will be resumed in the near future. The Ver Mehr Co., and William Cowlin Co. have the contract for constructing the plant.

Peterboro, Ont.—The city will pay $154,615 and interest for the lighting plant of the Peterboro Light & Power Co., expropriated last October, and will also pay the costs of the recent arbitration, which it is believed will be $10,000 or more.

Embro, Ont.—A committee outside of the council has been appointed to have charge of the local hydro system. This committee will consist of Reeve H. B. Atkinson, Dr. Green and G. M. Creighton, with C. E. McCawley as secretary-treasurer.

Vancouver, B.C.—Fire Chief Carlisle has recommended purchase of auto gasoline pump at $12,000; auto hose wagon at $7,400; auto water tower at $17,500, and that $38,100 be voted for purchase of new apparatus. City Clerk, W. McQueen.

Brantford, Ont.—A by-law will probably be voted on to sanction an issue of $30,000 of debentures. The money will

be expended on an addition 23 ft. x 45 ft., to the sub-station and also the installation of additional equipment for handling 3,000 h. p.

Newmarket, Ont.—The two by-laws recently ratified by the rate-payers authorizing the Council to enter into a contract with the York Radial for a supply of power and also to raise the sum of $15,000 by debentures, were given the third readings at a special session of the Town Council here last Monday.

Toronto, Ont.—Fire Department's estimates for 1915 include the following:—Special wire and cable, $1.132; 60 fire alarm boxes, $60,000; 4 tractors for service trucks, $26,000; 1 tractor or engine, $8.775; 1 tractor for aerial truck, $8,775; 1 combination chemical and hose truck, $6.000; 7.000 ft. of 2½-in. hose $7.000.

General Industrial

Welland, Ont.—T. B. Allan, of Toronto, will probably establish a factory here for making emery.

Preston, Ont.—It is reported that the Board of Trade has concluded negotiations with a company who propose taking over the vacant building erected for the Anchor Bed Co.

Cornwall, Ont.—Frank R. White of New York, formerly of Cornwall, has been in town with a view to interesting local people in the establishment of a branch of the American Master Organ Co. of New York in Cornwall.

Vancouver, B.C.—The Imperial Oil Co. announces the completion of its new refinery on Burrard Inlet, near Port Moody. The most modern equipment has been installed for the manufacture of products, of petroleum and the refining of that natural product itself.

Medicine Hat, Alta.—The Creelman Contracting Co., has taken over a big interest in the Purmal Brick Co., and in future this plant will be known as the Gas City Brick Co. A. G. Creelman, of Calgary, is the head of the new brick concern, and Geo. E. Hughes is secretary.

Montreal, Que.—H. E. Mann, engineer and gas expert, and J. S. Norris, manager of the Montreal Light, Heat & Power Co., paid a visit to the wells of the Canadian Natural Gas Co., at St. Barnaby, some eight miles from St. Hyacinthe, on Feb. 27. Fifteen wells are projected. Ten of these are to be ready by midsummer and if the results are satisfactory, as the promoters of the company expect, arrangements will be made for the laying of a pipe line to Montreal, a little over thirty miles, bringing the Montreal market, as well as that of St. Hyacinthe and other surrounding towns within ready reach.

Tenders

Hamilton, Ont.—Tenders will be received up to March 18 by the Board of Control for 3,160 feet of 36-in. cast-iron pipe and specials. Specifications and forms of tender may be obtained from A. F. Macallum, city engineer.

Winnipeg, Man.—Tenders addressed to the chairman, Board of Control, will be received up to Monday, March 22, 1915, for the supply of storage batteries for the new Central Fire Alarm Office equipment. Specifications may be obtained at the office of the City Electrician, Olafsen Block, Winnipeg. M. Peterson, secretary.

AID BELGIUM OR KEEP QUIET.

"Unless neutral nations are prepared to assist in throwing the Germans out of Belgium, no suggestions from them in the matter of preventing the further devastation of that country are wanted," said Sir Edward Grey, the Foreign Secretary, in the British House of Commons on March 4. The Foreign Secretary's statement was made in response to an inquiry from Frederick W. Jowett as to whether the Government was willing to invite suggestions from neutrals with a view to avoiding the further devastation of Belgium by the great powers which are contending for its mastery. The only solution of this question," Sir Edward continued, "is the evacuation of Belgian territory by German troops, the restoration of her independence and reparation for the wrong done her. Unless neutral powers are prepared to assist in securing that solution, I don't see what could be gained by the course suggested."

Port Hope, Ont.—Tenders will be received by the secretary of the Board of Water Commissioners until March 15 for the following work and materials:—Contract 3—Low-lift centrifugal pumps, motors, oil engine, piping and erection of same. 4—Venturi tubes, loss of head gauges, elevation gauges. 5—The construction of four slow sand filters, pump house and pure water reservoir. 6—Cast iron pipe and specials. 7—Valves and valve boxes. Plans may be seen and specifications obtained at the office of the engineers, F. W. Thorold Co., Ltd., 2 Toronto street, Toronto, Ont.

Fredericton, N.B.—Tenders will be received at the Department of Public Works, Fredericton, until March 31, 1915, for constructing the steel superstructure of a new bridge, to take the place of the present wooden highway bridge at Moncton over the Petitcodiac River; one through fixed riveted steel truss span of 355 feet from centre to centre of end bearings; four through fixed riveted steel truss spans of 261 ft., 6 in. from centre to centre of end bearings, according to plans and specifications to be seen at the Public Works Department, Fredericton, N.B. John Morrissy, Minister of Public Works.

Ottawa, Ont.—Tenders will be received until Thursday, March 18, 1915, for the construction of the superstructures of two (2) steel through truss highway bridges and of one (1) steel single-leaf highway Strauss Trunnion Bascule bridge over the Cataraqui River at Kingston, Ont. Plans and forms of contract can be seen and specification and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Shaughnessy Building, Montreal, Que., and on application to the postmasters at Hamilton, Ont., and Kingston, Ont.

Vancouver, B.C.—Tenders will be received up till March 31, for the supply of the following articles for the use of the B.C. dredging fleet at Vancouver, B.C., for 12 months ending March 31, 1916:—Hardware; packings; Manila rope; wire rope; chain; steam pipe, valves and fittings; oils and greases; paint, paint oils, etc.; hose; brooms and brushes; steel castings. Forms of tender may be obtained at the office of G. B. Hughes, district engineer, Victoria, B.C.; at the office of C. C. Worsfold, district engineer, New Westminster, B.C.; and at the office of J. L. Nelson, supt. of dredges, 614-18 Birks Building, Vancouver, B.C.

Ottawa, Ont.—Tenders will be received at this office until Wednesday, April 7, 1915, for the construction of one new chain of buckets, tumblers, together with spare parts, for dredge "Mastodon." Plans, specification and form of contract can be seen and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of A. Kastella, Esq., mechanical superintendent, Birks Building, Ottawa, Ont.; J. L. Nelson, Esq., supt. of dredges, Vancouver, B.C.; G. B. Hughes, Esq., district engineer, Victoria, B.C.; C. C. Worsfold, Esq., district engineer, New Westminster, B.C.; F. Y. Harcourt, Esq., district engineer, Port Arthur, Ont.; J. M. Wilson, Esq., acting district engineer,

Toronto, Ont., and A. E. Dubuc, Esq., district engineer, Montreal, Que.

Contracts Awarded

Toronto, Ont.—The Queen City Foundry Co., Toronto, has been awarded a contract by the Board of Control, for the supply of cast iron special castings at a cost of $2,145.

Brantford, Ont.—The contracts for three new statoins, at Port Dover, Simcoe and Waterford, for the Lake Erie & Northern Railway, have been let to P. H. Secord & Sons of this city. The contract price is $6,000 each.

Montreal, Que.—An order from the Greater Winnipeg Waterways Co. has been received by the Canadian Car and Foundry Co. The new business calls for the manufacture of forty 50-ton dump cars, as well as twelve smaller dump cars. The equipment will be made at the local plants and is valued at about $70,000.

Trade Gossip

The Algoma Steel Corporation, of Sault Ste. Marie, Ont., has secured an order for 25,000 tons of standard section rails from the Illinois Central Railway.

The Keeton Motor Car Co., Brantford, Ont., will build a number of motor cars for shipment to England and France. The president, F. M. Keeton recently returned from Europe.

French Government Orders.—Orders for artillery ammunition and harness for the French Government amounting to over five million dollars have been placed with Canada through the High Commissioner's office in London.

Elmira, Ont.—The Board of Trade elected officers as follows: President, M. L. Weber; vice-president, Geo. Klinck; secretary, W. L. Badley; treasurer, C. P. Ruppel; council, A. Werner, W. Cleghorn, A. E. Edwards, T. F. Shurley, O. H. Vogt, J. A. Schroder. The secretary's report showed the membership to be 110.

Dominion Steel Feb. Output.—February figures of the Dominion Steel & Coal Co. are more encouraging than was expected. The output of pig iron was larger than in February of 1914, and showed a considerable increase upon January of this year. The coal production in February was 97,000 tons larger than in January. An increase in rail production over January is particularly interesting. In February of 1914 the pig iron produced was 18,482 tons, ingots 23,960 tons, and coal 347,356 tons. The record for the first two months of this year follows:—

	Feb., 1915. Tons.	Jan., 1915. Tons.
Pig iron	20,621	17,856
Steel ingots	23,430	20,189
Rails	9,201	3,329
Bars	206	1,374
Wire rods	2,583	2,066
Wire and wire products	1,995	1,368
Coal	312,259	215,100

It will be noticed that only in the production of bars was there a falling off in February from January of this year.

Building Notes

Red Deer, Alta.—The Dominion Government will erect a public building here to cost $34,000.

MacLeod, Alta.—The Dominion Government will erect a public building here estimated to cost $25,000.

Merritt, B.C.—The Dominion Government propose to spend $25,000 on a post office and public building here.

Bassano, Alta.—A public building will be erected here by the Dominion Government. Estimated cost $15,000.

Brantford, Ont.—A building permit has been issued to the Slingsby Manufacturing Co. for a new boilerhouse to cost $1,000.

Renfrew, Ont.—A committee has been appointed to make application to the Carnegie Corporation for the necessary money to build a library.

Montreal, Que.—Work will begin shortly on the new Bancroft school. Nobbs & Hyde are the architects and A. F. Byers & Co., contractors.

Calgary, Alta.—The Dominion Government estimates for public building in Calgary include, customs warehouse, $15,000; drill hall, $100,000; post office, $110,000.

Edmonton, Alta.—The Federal estimates provide for the following: Post office addition, $100,000; customs examining warehouse, $75,000; drill hall, $200,000.

Toronto, Ont.—City Architect Pearse has granted a permit for an $80,000 brick factory, five storeys high, to be erected by Samuel and L. S. Yolles at 468 Wellington street west. It will be about 70 feet high.

Toronto, Ont.—The city architect's department has issued a building permit to R. C. Bustard for the erection of a six-storey terra cotta office building, costing $29,000, at the east side of Yonge street near Isabella street.

Windsor, N.S.—On the site where the Acadia Collegiate Academy formerly stood, will be erected a building of stone, to cost $40,000. The committee were instructed to secure plans, and just as soon as financial arrangements are completed, the building will be begun.

Winnipeg, Man.—R. Bingham, of the firm of Bingham & Drahonnet, of this city, states that he has completed all arrangements for the erection of a modern office building to cost $125,000 on the north-west corner of Portage and Garry. The detailed plans for the new edifice are now being prepared by Woodman & Carey.

Walkerville, Ont.—Tenders are being called for by the architects, G. Jacques & Co., for the construction of the new $50,000 separate school building to be erected on Niagara street. The structure will be 80 x 123 feet. In addition to the most modern heating and ventilating systems, a vacuum cleaning system will be installed in the new school.

Guelph, Ont.—The Toronto Suburban Railway Co. has taken out a permit from the office of the city engineer for the erection of a new transformer station. This station will be erected on Bay street, and will cost $4,500. It is expected that hydro-electric power will be used. Architect Briggs of Toronto has prepared the plans and he will at once ask for tenders.

Montreal, Que.—After the tenders of eleven firms for the construction of the new civic library on Sherbrooke street, at prices ranging from $442,000 to $534,000, were opened at the Board of Control meeting on Feb. 27, they were all referred to Alcide Chausse, building inspector, and to E. Payette, architect, for a report. The lowest tender for the construction of the building, according to the specifications, was given by John Quinlan & Co., at $466,000, and the highest by Alfred Pion at $534,000.

Wood-Working

Welland, Ont.—It is announced that a furniture factory will be established here. H. L. Halter is interested.

New Westminster, B.C.—Work has been started on shingle mill for The Mackie Mill & Mercantile Co., Gettysburg, Wash.

Kingston, Ont.—A fire destroyed the sawmill of S. Anglin & Co. on Feb. 16. The damage is $15,000, partly insured. Spontaneous combustion was the cause of the blaze.

Port Dover, Ont.—The Port Dover Planing Mills have decided to make extensions to their plant. An addition 20

ft. x 42 ft. will be built, also a drying kiln having a capacity of 40,000 feet.

Bancroft, B. C. — McLean, Strudwick & Delyea have secured a site from Fair & Mullett, adjoining the electric light plant, and are already at work on the foundation for a planing mill. They will use water power.

Lunenburg, N.S.—Fire broke out in the saw and planing mill of Smith & Rhuland's shipyard on Feb. 24. The building and machinery were badly damaged by fire and water. There was no insurance.

Railways-Bridges

Toronto, Ont.—Tenders will be called shortly for the building of a bridge over Merton street.

Windsor, Ont.—The city is interested in the hydro-radials project, and a campaign will be started to further the scheme.

Campbellford, Ont.—The Dickson Bridge Works Co. have secured the contract for erecting a new bridge on the Intercolonial Railway, their tender being about $14,000.

Prince George, B.C.—The G. T. P. has started excavations for two big oil tanks here to hold 35,000 gallons each. It is stated the railway will soon use oil on its engines between Edmonton and Prince Rupert.

Calgary, Alta.—The ratepayers having turned down a by-law to raise the sum of $165,000 for the construction with concrete of the Louise Bridge, it is now proposed to put up a steel structure similar to the one already existing, on the same abutments and piers, at an estimated cost of $40,000.

Ottawa, Ont.—The application of the C. N. Q. R. for authority to construct sidings across Stadacona and Marlborough streets, in Hochelaga ward, Montreal, has been granted by the Railway Commission. The railway desires the crossings as part of an extension of its Moreau street yards.

Kincardine, Ont.—The delegation, consisting of J. J. Hunter, Dr. Armitage, Thomas Reed, which was sent by the town to interview the Provincial Government re the possibility of getting a radial road to go from Sarnia to Owen Sound, got a promise that the Government will take the subject into consideration.

Grimsby, Ont.—It is reported that the Grand Trunk is considering building a railway from Grimsby to Port Maitland on the West side of the Grand river, making a short cut from Toronto and Hamilton to Lake Erie, to share in the coal trade and other important manufacturing which is expected to be located there.

Toronto, Ont.—Mayor Church has announced that twenty-five members of the Ontario Hydro-Electric Radial Railway Union would go to Ottawa this week to ask the Dominion Government to grant a subsidy of $6,400 a mile to the hydro radials. Sir Adam Beck, Mayor Church and J. W. Lyon, of Guelph, will form part of the deputation.

C.P.R. Extensions.—Grant Hall, vice-president of the C. P. R., in charge of western lines, states that the company has taken over since 1908 more than 3,000 miles of new track. In the same period 789 miles of second track has been put in operation; and the sections of the railway between Macleod and Lethbridge and between Field and Hector, have been rebuilt. In addition to all this, the company's terminals have all been practically rebuilt during the period mentioned. Mr. Hall thought that the Rogers Pass tunnel would be finished in two years. The company, Mr. Hall stated, contemplated operating the completed section of the Kettle Valley road this summer—a service to the coast being afforded by way of Midway, Penticton, Princeton, Merrit and Spence's Bridge, from Nelson. Mr. Hall referred to the Kootenay Central Railway which now affords an important link between the prairie provinces and British Columbia — joining the main line at Golden.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Personal

J. D. McBeath, assistant engineer of Medicine Hat, Alta., has sent in his resignation.

R. O. Wynne-Roberts, consulting engineer to the city of Regina, will resign at the end of May.

William Snider, vice-president of the Waterloo Mfg. Co., Waterloo, Ont., died on March 8, aged 68.

A. J. McGee, secretary of the Timiskaming & Northern Ontario Railway Commission, passed away at Toronto, on March 1 at the age of 38.

George T. Merwin has been made general sales manager of the Canadian Car & Foundry Co., Montreal. He was formerly with the W. W. Butler Co., Montreal.

J. Orr Callaghan, general manager of the Steel Company of Canada, has returned to Hamilton after an inspection of the company's new plant at Fort William, Ont.

Captain Murdock McLean, of Duluth, died here on March 4, of heart trouble. He was born in Kincardine, Ont., 60 years ago and spent most of his marine career in Canadian fleets.

Mining Institute Officers.—The Canadian Mining Institute ,at their annual meeting last week, elected the following officers:—President, G. G. S. Lindsay, Toronto. Vice-presidents—Thomas Cantley, New Glasgow, N.S., and A. Cole, Cobalt, Ont. Council—Prof. Buker, Kingston; John Bell, Montreal; R. W. Brock, Vancouver; T. Denny, Quebec; D. A .Dunlop, Toronto; M. B. Gordon, Cobalt, Ont.; S. S. Mackenzie, Ottawa; D. T. McDougall, Sydney, N.S.; J. T. Stirling, Edmonton, and A. F. Young, Toronto.

Arthur J. Darling, president of Darling Bros., Ltd., engineers and manufacturers, Montreal, died on March 5, at his residence, 73 St. Luke Street, at the age of 52. He had been in ill health, but his death was not expected. He was the son of the late Thomas Darling, an accountant. Mr. Darling belonged to the Montreal Curling Club, and was president of the Whitlock Golf Club, Hudson Heights, of which he was one of the founders. He is survived by his widow and three young children, two sons and one daughter.

Lieut.-Col. Lacey R. Johnson, general superintendent of the C. P. R. Angus Shops District, has been appointed to the position of general welfare agent, to co-operate in the development of such organizations as the St. John's Ambulance Association, the Safety First movement, the Railroad Y.M.C.A., and Athletic Associations, amongst the employees of the C. P. R. Mr. Johnson, who joined the C. P. R. service in 1882, and has had a wide experience in rail-

way shops as foreman, master mechanic, and superintendent, was born at Abingdon, Berkshire, England, June 22, 1885. He has been general superintendent of the Angus Shops, Montreal, since July 1, 1912.

Refrigeration

Quebec, Que.—A new abattoir may be built by the Quebec Abattoir Co.

Calgary, Alta.—H. Van Buskirk, manager of P. Burns & Co., says his firm will have a cold storage plant at Rossland, B.C.

New Liskeard, Ont.—A committee has been formed among residents of this district to make preliminary arrangements for establishing a creamery. W. A. Houser, of Earlton, is chairman.

Regina, Sask.—It is announced that prominent Regina financiers are at present interested in the organization of a meat packing plant. It is proposed to organize a company capitalized at $20,000.

Windsor, Ont.—Contracts have been awarded to the Huettner, Creamer Co. of Detroit to erect a 20-ton artificial ice plant for the Bell Ice Co., of Windsor. The building will be erected on Albert street and will be of brick and steel. It will cost about $20,000. The new plant will be in operation by May, according to Fritz Bridges, manager for the Bell Ice Company.

St. Stephen, N.B.—The big plant of the Canadian Sardine Co. at Chamcook, which has been in the hands of the Bank of Nova Scotia for several months, and which was erected at a cost of nearly a million dollars, has been purchased from the bank by Laing, Libby & Co., of Boston, at private sale. The new firm will erect a cold storage plant in connection with the present big outfit and will carry on the fish business in all its branches.

Montreal, Que.—A re-organization of the Ice Manufacturing Co., Ltd., has been effected, whereby the concern passes under the control of a new and strong directorate, the officers and personnel of which are as follows: L. J Smith, president; F. W. Molson, vice-president; B. Tooke, J. A. Cameron, Jas. Baillie, J. J. Robson and H. R. Drackett. Arrangements are being made to place the company in a stronger financial position, and, in addition, the company has entered into an arrangement with the Montreal Arena Co. to manufacture and supply ice for Westmount and Notre Dame de Grace, as its own output has already been contracted for.

Marine

Toronto, Ont.—Hoping to get an early start this spring, steamboat owners have begun outfitting their steamers.

Oshawa, Ont.—In the Dominion Government estimates, $50,000 has been appropriated for harbor improvements here.

Sarnia, Ont—The G. T. R. has begun to dismantle the Northern Navigation wharf here and will erect a new structure about 800 feet long.

Halifax, N.S.—The Halifax Marine Engineering Co. has secured the contract for renewals and repairs to machinery piping and supply of boilers for the Canadian Government steamer Tyrian, at $16,750 and $9,200.

Victoria, B.C.—The Federal estimates for the current year contain large appropriations for both Victoria harbor improvements and the Esquimalt drydock. In the first instance, the sum is $1,400,000, and in respect to the drydock, the sum named is $250,000.

Navigation Season Opening.—It was announced on March 4, that the White Star Line running between Sarnia and Detroit would start its river service April 1. The Wauketa will be the first boat. The tug Fischer is the first steamer to open navigation at Sarnia, she having taken some machinery from there to Port Huron.

Collingwood, Ont.—The St. Lawrence & Chicago Steam Navigation Co. announces the following appointments of captains and engineers to its steamers: J. H. G. Hagarty—Capt. Samuel Hill, Chas. Robertson; E. B. Osler—Capt. C. E. Robinson, Wallace Robertson; W. D. Matthews — Capt. Wm. Cunningham, William Harwood; G. R. Crowe—Capt. J. H. Hudson, William Reid; Iroquois—Capt. D. A. Kennedy, Jas. E. Readman.

Fort William, Ont.—It is stated that the contract for the construction of two thousand feet of breakwater on the Mission river, Fort William, has been awarded to the Thunder Bay Contracting Co., and that work will be commenced on the new breakwater as soon as navigation opens. The cost of this work will be possibly in the neighborhood of a quarter of a million dollars, which forms part of the $1,200,000 in the Parliamentary estimates, for harbor improvements at the head of the lakes this year.

Algoma Central Steamship Co. — The Algoma Central Steamship Co. have made the following appointments of captains and engineers to their steamers for the ensuing year: Str. W. C. Franz—Captain W. C. Jordan, George Sylvester; Str. J. F. Taylor—Captain R. H. Boyle, L. R. Cronk; Str. Agawa—Captain J. A. Brown, J. L. Smith; Str. J. T. Drummond—Captain A. McIntyre, W. T. Rennie; Str. J. A. McKee—Captain H. C. Wingrove, John Knight; Str. Paliki — Captain R. J. Bassett, A. M. McInnes; Str. E. G. Carter—Captain C. H. Wilson, R. J. Sullivan.

Prince Rupert Drydock.—According to information given by G. T. P. officials, the new drydock at Prince Rupert will be completed in May, and ships will be docking there regularly next summer. G. T. P. vessels have, to the present, been going into drydock at Esquimalt. The new dock is designed to take vessels up to 25,000 tons, and will be the biggest on the coast with the possible exception of the one at San Francisco. It is being constructed with a view to trans-Pacific trade, and it will handle with ease two vessels the size of the Prince George or the Prince Rupert end to end.

New Incorporations

Lever Brothers, Ltd., Toronto, have been authorized to increase their capital from $3,000,000 to $4,000,000.

Curtiss Aeroplane & Motors, Ltd., has been incorporated at Ottawa, Ont., with a capital of $50,000, to manufacture aeroplanes, sea-planes, etc., at Toronto, Ont. Incorporators—J. S. Lovell, W. Bain and R. Gowans, all of Toronto, Ont.

Aube's Automatic Smoke Consumer Co. has been incorporated at Ottawa, Ont., with a capital of $50,000, to manufacture an automatic smoke consumer at Montreal, Que. Incorporators—O. Aube, A. Roy and E. Viau, all of Montreal, Que.

The Dominion Fibre Co., has been incorporated at Toronto, Ont., with a capital of $40,000 to manufacture wool stock, curled hair and felts, etc., at the village of Doon, Ont. Incorporators: J. H. McNally, M. J. Huber of Regina, Sask., and Homer V. Huber, of Doon, Ont.

The Alliance Lumber Co., has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on the business of a planing mill and to manufacture wooden ware, etc., at Hamilton, Ont. Incorporators: R. J. Press, M. Cole and Daniel Cole, all of Hamilton, Ont.

Wettlaufer Bros., Ltd., has been incorporated at Ottawa, Ont., with a capital of $300,000, to manufacture all kinds of machinery, automobile supplies and accessories at Toronto, Ont. Incorporators—C. L. Wettlaufer, J. L. Wettlaufer and E. L. Wettlaufer, all of Toronto, Ont.

The Textile Mfg. Co., has been incorporated at Ottawa, Ont., with a capital of $50,000 to carry on the business of cloth manufacturers at Toronto, Ont. Incorporators: R. W. Hart, W. G. Lumsden and C. H. C. Leggott, all of Toronto, Ont.

Zenith Machine Co. has been incorporated at Ottawa, Ont., with a capital of $50,000, to carry on the business of iron and steel makers and machinists at Midland, Ont.; head office at Montreal. Incorporators—J. W. Blair, F. H. Laverty and C. A. Hale, all of Montreal, Que.

Efficiency Boiler Heating Co. has been incorporated at Ottawa, Ont., with a capital of $100,000, to carry on the business of manufacturers of furnaces, stoves, ranges, etc., at Ottawa, Ont. Incorporators—W. N. Graham, H. Hastings Short and H. G. Rouleau, all of Ottawa, Ont.

The Globe Graphite Mining and Refining Co., Ltd., has been incorporated at Toronto, Ont., with a capital of $500,000, to take over the Globe Refining Co., Ltd., at Port Elmsley, Ont. Incorporators—G. N. Brewer and J. W. Brewer, of Buckingham, Que., and W. T. Sinclair, of Toronto, Ont.

Clarke Products, Ltd., has been incorporated at Toronto, Ont., with a capital of $40,000, to manufacture automobile heaters and accessories at Toronto, Ont. Incorporators—J. Y. Murdoch, J. Young Murdoch, and G. M. Sinclair, all of Toronto, Ont.

The British Columbia Skeena Coal Co. has been incorporated at Ottawa, with a capital of $1,000,000, to mine for coal or other minerals. The head office is at Quebec, and the incorporators are the Hon. Philippe A. Choquette, the Hon. Nemese Garneau and James G. Scott, all of Quebec City.

The Canadian Brown Scientific Tube and Accessories, Ltd., has been incorporated at Ottawa, Ont., with a capital of $50,000 to manufacture automobiles, auto-cars, motor vehicles, etc., at Ottawa, Ont. Incorporators:—J. A. Brennan, W. J. Wallace, and D. E. Winter, all of Ottawa, Ont.

Mines Development, Ltd., has been incorporated at Ottawa, Ont., with a capital of $50,000, to carry on the business of a mining reduction and development company, with head office at Toronto, Ont. Incorporators—E. F. Mayo, A. E. Hollingsworth, and E. Stanley Ball, all of Toronto, Ont.

The Mond Nickel Co., Ltd., has been authorized by the Ontario Provincial Government to carry on business in the Province as manufacturers, refiners, smelters, etc., of ores and metals of all kinds. The capital of the company may not be greater than $10,000,000. John M. Clark of Toronto is the attorney.

The Montreal Architectural Iron Works, Ltd., has been incorporated at Ottawa, Ont., with a capital of $50,000 to carry on the business of manufacturing and installing ornamental iron, brass and bronze work, at Montreal, Que. Incorporators: T. J. Coulter, W. S. Jones and A. Roberts, all of Montreal, Que.

The Western Salt Co. has been incorporated at Ottawa, Ont., with a capital of $250,000 to develop salt or brine at Toronto, Ont. Incorporators: G. Ruel, R. H. M. Temple and G. N. Limpricht, all of Toronto, Ont.

Commercial Electrics, Ltd., has been incorporated at Ottawa, Ont., with a capital of $500,000 to carry on the business of electricians, mechanical engineers and manufacturers at Toronto, Ont. Incorporators: G. R. Kappele, G. H. Morgenstern and H. Eddington, all of Toronto, Ont.

New Idea Spreader Co. has been incorporated at Ottawa, Ont., with a capital of $250,000, to manufacture spreaders and all other agricultural implements and equipment at Guelph, Ont. Incorporators—B. C. Oppenheim, J. A. Oppenheim, and C. A. Nullenix, all of Coldwater, Ohio, U.S.A.

American Equipment Co. of Canada, Ltd., has been incorporated at Ottawa, Ont., with a capital of $5,000, to carry on the business of manufacturing metal goods of all kinds, tools, machinery, etc., at Montreal, Que. Incorporators—W. K. McKeown, H. Lacerte and G. E. Chart, all of Montreal, Que.

The Sweetgrass Exploration and Development Co. has been incorporated at Ottawa, Ont., with a capital of $500,000, to manufacture and refine mineral oil and any products thereof, at Toronto, Ont. Incorporators—W. F. Langworthy, A. J. McComber and L. V. McComber, all of Port Arthur, Ont.

The American Equipment Co., of Canada, Ltd., has been incorporated at Ottawa, Ont., with a capital of $5,000 to carry on the business of manufacturing tools, machinery, boilers, furnaces, etc., at Montreal, Que. Incorporators, W. K. McKeown, H. Lacerte, and M. B. Flanagan, all of Montreal, Que.

Canada Model & Machine Co. has been incorporated at Ottawa, Ont., with a capital of $40,000, to carry on the business of manufacturers of all kinds of hardware specialties and machinery at Windsor, Ont. Incorporators—W. J. Pulling, A. N. McLean and J. A. McLean, all of Windsor, Ont.

Ottawa, Ont.—The Ontario Niagara Connecting Bridge Co. is applying to Parliament for an Act of incorporation with power to construct and operate a railway and general traffic bridge over the Niagara River from some point within 6,000 feet south of the intersection of the northerly boundary of Welland County with the Niagara River.

Catalogues

Goggles.—Eye protectors of various styles are described in a bulletin issued by T. A. Wilson & Co., Inc., Reading, Pa. Each style varies to suit particular requirements, and illustrations are given, accompanied by a brief description.

Radial Drills.—George Swift & Sons, Halifax, England, have sent us a circular No. 33, describing their universal radial drill and tapping machine. Brief particulars are given of several sizes which are also illustrated. Other types dealt with are a switchboard drilling machine and a motor driven double hinged radial. A list of machine tools ready for delivery is included.

Uehling CO_2 Meters.—Bulletin No. 103 issued by the Uehling Instrument Co., Passaic, N.J., illustrates and describes the standard styles of CO_2 and combined CO_2 meters, also temperature machines and the recorders and indicators used with them. Each type is illustrated and accompanied by a brief description covering the principal features and purposes for which it is best suited. In the concluding pages reference is made to the savings that can be effected by installing these appliances. A data sheet is also appended.

Fabroil Gears is the title of an attractive bulletin No. 48,702 recently issued by the Canadian General Electric Co., Toronto. The publication of this bulletin coincides with the fifth anniversary of the invention of Fabroil gears, formerly known as cloth pinions, and presents to the entire machinery trade a collection of illustrations showing the variety of applications for which these gears have been found well suited. The illustrations are excellent and show in a clear manner the gears or pinions operating under varying conditions.

Motor Converters.—Bruce, Peebles & Co., Edinburgh, Scotland, have sent us pamphlet No. 20 D, just off the press. In this publication a very full description is given of the Peebles motor converter accompanied by several excellent illustrations showing the machines and installations. Simple explanatory dia-

grams are also to be found, together with characteristic curves, both for lighting and traction sets. On page No. 19 a most interesting comparison is given of motor converters with rotaries and motor generators, while on the last page there is a list of some of the more important motor converter users.

Boiler Feed Regulators.—The Northern Equipment Co., Erie, Pa., have issued a catalogue dealing with the Copes boiler feed regulators and pump governors. In part 1, the principal features of the Copes submerged tube regulator, also its construction and method of installation are fully described. Following are particulars of a number of tests accompanied by charts showing comprehensively the performance of the submerged tube regulator during the tests. The Copes feed valve is also described and tables are included giving the principal dimensions of each size. Part 2 describes fully the Copes regulator for 1/4 in. regulation for conditions when it is desired to feed exactly in proportion to evaporation. The catalogue is fully illustrated and contains views of the apparatus installed in several boiler plants, etc. Copies of the catalogue may be obtained from H. L. Peiler & Co., Montreal and Toronto.

MORE RAIL ORDERS FOR ALGOMA STEEL CORPORATION.

COMPETITION by the Algoma Steel Corporation, of Sault Ste. Marie, Ont., for rail tonnage in the United States against the makers in that country, has assumed more important proportions, with the placing with the Canadian concern of an order for 20,000 tons by the Illinois Central Railroad. This is the largest order yet taken by the Ontario mill, and it brings the aggregate of such sales to probably 40,000 to 50,000 tons, which have been entered at \$2 to \$3 a ton be-

low the prices of American mills. The Algoma Co., in addition, has taken 500 tons for the Toledo Terminal Railway Co. and 500 tons for the Northern Ohio Traction Co. As previously reported, it also has received 4,000 tons for the Hocking Valley, 5,500 tons for the United States section of the Pere Marquette, about 1,500 tons for one of the New York Central lines and probably other lots.

ONTARIO WORKMEN'S COMPENSATION RATES.

FROM the experience of the Workmen's Compensation Board for the two months that the Act has been in operation it appears that the amount of the assessment levied on the different groups of industries was higher than will be required to meet the claims likely to be made. While this was the view of the Board, there was some doubt as to the wisdom of making the assessments lower, but it looks now as though the rate would be lowered at the end of the present year.

Since January first, 1,888 accidents have been reported to the Board, and 685 have been laid aside because the injuries sustained did not last longer than seven days. These figures apply to schedule 1, which includes industries grouped together. Under schedule 2, which is railways, corporations and municipalities, some 416 claims have been received. The Act appears to be working smoothly.

DOMINION REVENUE INCREASE.

FOR the month of February the Dominion revenue shows an increase of $825,224 as compared with February of last year. This is the first increase in revenue reported for a year or so. The increase is in the main made up of $148,864 in customs revenue, $381,520 from excise, and $146,858 from railway receipts. The increased customs and excise receipts reflect the result both of the increased tariff and excise duties and of the rush of importers and manufacturers to forestall the expected increased taxes announced in the Finance Minister's Budget speech in the middle of the month.

Expenditure for the month shows a considerable drop, as compared with February of last year. Current expenditure decreased by $1,488,431, and capital expenditure by $555,732.

The net public debt increased during February by $6,513,392, and is now for the first time over the four hundred million mark. At the end of the month it was $401,891,909, as compared with $317,169,801 at the end of February last year, an increase of $84,222,108 during the twelve months. Temporary loans made by the Government now total $53,666,666, as compared with $18,006,666 on February 28, 1914.

Shrapnel Shell Service and Constructional Features

Staff Article

Arising out of this European war, not the least interesting feature, if only on account of its novelty, although its significance is much more diversified and potent because of the stimulus given to both our industries and to our Empire patriotism, was that of the decision to manufacture shells in Canada. Interesting data relative to shells generally are here given.

IN view of the fact that shrapnel shell manufacture has developed to an extent hardly anticipated when the Annual Review Number of Canadian Machinery was published on December 31, 1914, and in response to numerous requests from interests only indirectly in touch with affairs mechanical, we have pleasure in reproducing in part the article which appeared in that issue entitled "The Manufacture of Shells, an Impromptu Canadian Industry."

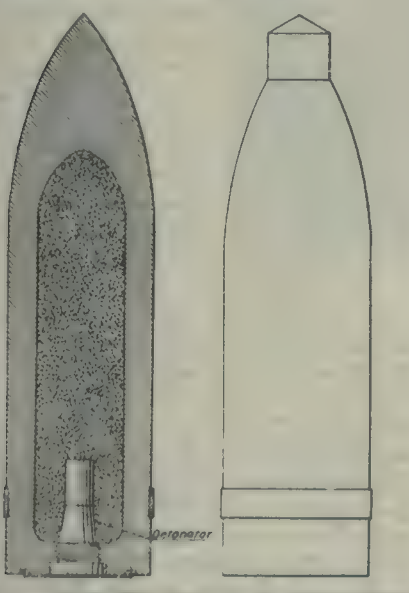


FIG. 1. SIMPLEST FORM OF EXPLOSIVE PROJECTILES.

Projectiles, commonly known as shells, have a number of different purposes and vary widely in construction. In Fig. 1 is shown a simple and much-used form of explosive projectile. The explosive charge is seen encased in the solid steel of the shell and is provided with a detonator at the rear end which is intended to explode the charge upon impact or immediately afterwards. The left half of the figure represents a projectile designed for the destruction of fortresses, earthworks, etc., where high explosive power is required. When required to pierce hardened steel armor, this shell is provided with a covering of softer metal over the hardened point. Otherwise the shell would simply shatter itself without perforating the hardened projective surface.

Shrapnel Shells.

For the destruction of men and other animate objects, the type of projectile known as shrapnel is employed. Two typical shrapnel projectiles are shown in Fig. 2, and their operation is as follows: The nose or time-fuse can be adjusted to explode the shell at any predetermined time after its discharge from the gun, and an effort is made to have the shell explode about a hundred yards in front of the enemy and directly above him. The case is made of a high grade of steel and is not itself shattered.

The flame from the time-fuse explodes the powder in the central tube and the rear end of the shell. This simply blows the fuse-end off and discharges the whole load of bullets straight ahead as if shot from an enormous shotgun. The explosive charge is not large in comparison to the weight of metal discharged but, as the projectile as a whole has a very considerable initial velocity, each bullet will have sufficient energy to administer a disabling wound at 100 yards, and bullets enough are provided to furnish one for every square yard of surface attacked.

Timing Arrangements

Shells are timed both by clockwork and by a time fuse. A typical example of the latter is shown in Fig. 3. Upon discharge from the gun the inertia of the percussion plunger P causes it to shear off the resistance ring R and fly back against the firing pin A which explodes the primer charge J. The flame from this passes

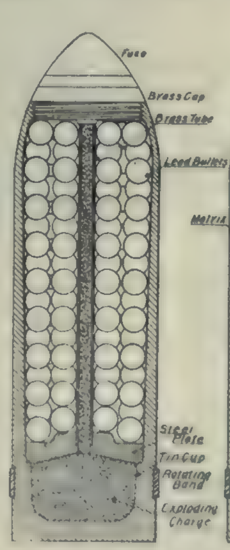


FIG. 2. TYPICAL FORMS OF COMMON SHRAPNEL.

through the hole B and ignites the fixed time-train C. This fixed time-train burns around until it comes to the hole E, through which the flame can pass to the

movable time-train at its lower end. The movable time-train burns back until the hole D is reached through which the flame obtains access to the powder G which forms part of the bursting charge of the shell.

It is easily seen that, by rotating the movable ring M so that the holes E and D become further separated around the circumference of the shell, the time required for the train C to burn around to the hole E and back along the movable train to the hole D is increased. The time allowed, of course, depends upon the distance the shell has to travel from the gun to the point where it is desired to discharge the bullets, and if the holes E and D be placed directly in line, the shell will explode but a few feet from the muzzle of the gun.

The time-train rings do not form complete circles so that for transportation, or if it be not desired to use the time fuse, the hole E is set opposite the blank part of the time train C. In case the shell fails to explode through the agency of the time-fuse, it will explode upon impact. Upon firing, the percussion ring H slips back over the plunger which carries the firing-pin K. Upon impact of the shell with some solid object, the whole flies forward, the pin K exploding the primer charge T. This instantly ignites the exploding charge G through the tube O.

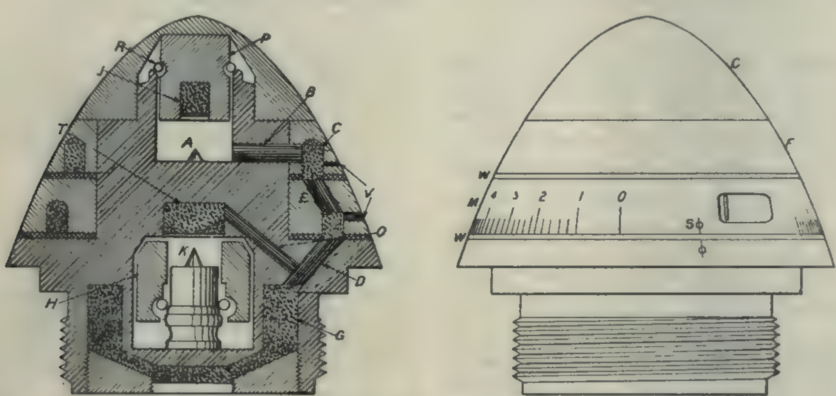


FIG. 3. DETAILS OF ADJUSTABLE TIME FUSE.

The Explosive.

The explosive used in all kinds of shells is, in nearly all cases, a high grade of black powder. Few of the higher explosives are suitable for this purpose. Any of the compounds of nitro-glycerine or other explosives which are liable to detonate by shock are manifestly unsuitable. Many deteriorate in long storage, and acids will react with the metal walls of the projectile. Picric acid or its salts, alone or in combination with other substances intended to make it less sensitive to detonation, are much used in the form of the Japanese shimose and the British lyddite. Great care must be exercised with these, however, to prevent the explosives coming in contact with the metal surface of the shell.

The Canadian-Made Article.

In Fig. 2, the left-hand figure represents a typical 18-pound British shrapnel shell such as, along with 15-pounders, are, at present, being made in large quantities in Canadian factories. The body is forged by hydraulic pressure from a solid billet of high grade steel, and the machining represents two simple series of operations on turret lathes. After the finishing of the machine work and inspection, the cases are subjected to a heat treatment and oil quenching.

The brass cap which screws into the steel body and carries the fuse is turned from the rough casting in four turret lathe operations and is fitted with a brass plug for the purpose of protecting the thread until the fuse, which is made at the Government Arsenals is screwed in place. The fuse is kept from becoming loose and screwing out by means of small grub screws.

The central pipe carrying part of the explosive charge is of drawn brass tubing cut to length; shouldered and threaded to screw into the steel plate at its lower end, and is soldered into the brass cap at the top. The powder is contained in a tin cup which is formed accurately to fit the inside of the base of the shell. This means simple press and soldering operations. The bullets, which are about one-half inch in diameter and, of which 364 are required for each shell, are made of a mixture of lead and antimony and are formed cold in dies under presses. The copper rotating bands are rolled to size and are fastened in place by means of a closing press for the purpose. The interstices between the bullets are filled with a matrix composed of certain forms of pitch or other inflammable substances designed to protect the bullets from deformation when the shell is being discharged from the gun, and to indicate by its smoke, the exact point where the explosion of the shell takes place.

All the work in connection with the making up of the shell need not be done in a single plant or by a single firm. They are completed with the exception of the bursting charge and addition of the fuses, and are packed in special wooden crates designed to hold six each for shipment. The distribution of the contracts for the manufacture of shells in Canada is in the hands of a special shell committee, and the difficulties encountered in placing, collecting, assembling and inspecting the wide variety of the work involved are much greater than is realized by the man not directly in touch with the task. Some seemingly insurmountable obstacles have been met and overcome and, at the present time, the work is being done almost entirely in Canada, by Canadians, creditably alike to the latter and to the Empire of which they form a part.

MANUFACTURE OF SHRAPNEL.

THE machining of shrapnel shell cases, while apparently an easy task, presents a problem which demands much careful consideration, especially with regard to the tool arrangements for the various operations. In the manufacture of these cases, the accepted English practice is to make them from very tough material in the form of hollow forgings.

As regards physical properties, the steel from which they are made has to fill very exacting requirements. The finished shell case is more than a piece of steel bored and turned to certain dimensions; it must be capable of withstanding roughly a pressure of 14 tons per square inch from the explosion of the cartridge which drives it out of the gun. Further, there is a charge of powder in the base of the shell, which, when exploded, either with a time or percussion fuse, bursts open the head, and forces the bullets out of the case; this bursting charge exerts a pressure of about 10 tons per square inch. In addition, there is an enormous torsional stress, caused by the rotation of the shell under the action of the rifling in the bore of the gun.

From the foregoing it will be seen that the case is necessarily made from a high tensile steel, which, in practice, generally has a carbon content of about 0.75 per cent. This material is tough, and exceedingly difficult to machine; in fact, even with the best grades of super-high-speed steel, it is impossible to turn it at more than 30 to 35 ft. per minute. One of the postulates, therefore, in the design of the cutting tool is that they shall be simple in form, and easily removed and reset when grinding becomes necessary.

Two Distinct Systems.

When embarking on the manufacture of shells it is possible to proceed by

either of two very distinct courses. The first and older way is to install a plant of simple machines, each one being designed to perform one simple operation, the shell being passed from machine to machine until completed. The objection to this course is, however, the large amount of equipment required, necessitating large workshops and a great number of men. In addition to this, plants laid down on these lines are comparatively useless for other work, so that the capital spent upon the machines is likely to be unproductive when the demand for shells disappears.

The second course is to install machines of high productive capacity, consisting of a suitable combination of engine lathes with capstan or combination turret lathes. Such a plant occupies less floor space, requires a correspondingly less expenditure on buildings, and requires a smaller number of men. It also has the very great advantage that when the demand for shells ceases it is still entirely suitable for the manufacture of general work by modern productive methods.

The great demand for projectiles caused by the war has led many engineers to take up shell manufacture who had no previous experience, with the result that the cost at which shells are produced varies astonishingly in different works. Some makers producing the same article are working for a bare living, where others, by the use of better methods, are making a handsome profit at equal contract prices.

The proper course to adopt is to consult manufacturers and suppliers of engine lathes and turret lathes who know what is wanted in shell manufacture. Where sufficiently full particulars are furnished it is possible for such leading machine tool firms to give a guarantee of output, and to make the purchase of the plant dependent upon the fulfilment of these guarntees.

NOTES ON ORDNANCE.

THE action and conditions existing in a modern heavy gun were described graphically some years ago by a president of the French Society of Civil Engineers. In the case of a gun firing, in two minutes seven shells, each weighing 660 lbs., the 3,200 cubic feet of gas produced by 220 lbs. of smokeless powder develops in the gun bore a maximum pressure of nearly 18 tons per square inch and subjects the breech mechanism to a load of 2,600 tons.

Under the action of these gases (lasting 75-10,000ths of a second) the projectile leaves the muzzle with 40,000 foot-tons of energy, and is able to pierce 22 inches of steel two miles away. The gun and the moving parts of its mounting weigh 47 tons and recoil 3 feet in a quarter of a second, their motion being checked by the 200 tons resistance offered by a hydraulic buffer, so that the speed of recoil at no moment exceeds 22 feet per second (15 miles an hour). At the same time, the running-out gear stores energy to return the gun to its firing position in three seconds.

THE 12-INCH SIEGE HOWITZER OF THE AUSTRIAN ARMY.

This 30.5 centimeter Howitzer is capable of elevation up to 65 degrees, recoils 6 ft. at each discharge, and fires a shell weighing over 1,000 lbs. The barrel weighs 6½ tons, and the total weight, including recoil equipment and mounting is a little more than 28 tons.

—Courtesy Ill. London News.

So excellent is the braking and recoil gear on modern field guns that six to twelve rounds or more can be fired without "re-laying" the weapon. Nevertheless, due to variable windage, imperfect balance in shell walls, variable resistance offered by the driving band to the rifling, variations in the force of explosion and varying recoil jump, it is impossible to ensure two rounds hitting exactly the same spot, and the "sheaf of fire" of an 18-pounder quick-firing gun at 2 miles range is about 85 yards by 5 yards.

Theoretically, a gun barrel should be so long that the gases expand completely by the time the shell leaves the muzzle, but in practice a shorter barrel (25 to 35 calibres in the case of a field gun) is employed for obvious reasons. Smokeless powders, as now invariably used, maintain high pressure behind the shell so long as it is in the barrel and thus impart maximum energy to it. Black powder generates high pressure very quickly, but does not maintain its driving action so well.

Heavy British guns are built on the wire-wound principle, but most other nations use the shrunk-on tubular construction. Forged steel is then used, typical specifications for inner tube, jacket and hoop materials being:—Elastic limit, 46,000, 48,000, 53,000 lbs. per square inch; tensile strength, 86,000, 90,000, 93,000 lbs. per square inch; with elongation, 17 per cent., 16 per cent. and 14 per cent. respectively.

It will be noticed that the weakest material is used for the tubes, which are actually exposed to highest stress in working, the explanation of this anomaly being that the highest specification could hardly be met in the heavy forgings required for gun tubes; also, greater elongation values are obtainable in the lower limit steels, and are, of course, desirable in the heavily strained tubes.

RANGE FINDING AFLOAT.

"A RANGE FINDER on a battleship, is an ingenious optical contrivance which gives the observer who looks into it exactly the view he would have if his eyes were twenty-one feet apart," says a U. S. navy officer. An enemy's ship, therefore appears as if seen from two points of view separated by that distance.

"This line, twenty-one feet long, represents the base of an imaginary triangle, the apex of which touches the hostile vessel. The instrument shows the two angles at the base of the triangle, which, together with the known length of the base, give the distance of the enemy's craft, or in other words the range.

"There are three or four other range finders in various places, on top of the turrets or elsewhere, each instrument being erected on a tripod. The observations of all of them are communicated by telephone to the plotting room, which is under the water line of the ship. There the whole problem is worked out on a mathematical basis, but with the utmost celerity, and thence the proper ranges for the guns are sent to the turrets.

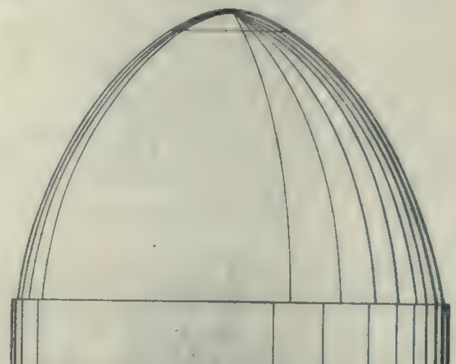
"Officers of exceptional cleverness are employed in this kind of work, on which so much depends. The spotting room is provided with all sorts of instruments, including a master dial, with a switch which, when turned to one figure or another, causes corresponding figures to appear on dials in all of the turrets.

"It might be said incidentally that the range finders give ranges that are only approximately to be relied upon. because various conditions may affect the shooting. Thus, for example, gunpowder does not give in damp weather the same propelling force to the projectile as in dry weather. It is particularly at long range that the finders are useful. At short range the gunners are able to get along very well without their help, each turret officer doing his own spotting and correcting his range by observation of the fall of his shells.

"The fighting of the ship is directed by the captain from the conning tower, in which are the steering wheel, a compass, voice tubes, engine signals, and telephones communicating with all parts of the vessel. It is he who gives the order to open fire on the enemy, who governs the steering of the vessel, and who indicates when torpedoes are to be discharged."

RANGE OF NAVAL ACTIONS.

ONE of the uncertain points in naval warfare is the range at which an action between battleships of hostile fleets would take place, and this is a question that has yet to be solved. In the Russo-Japanese war the range was frequently 5,000 yards, but since that time the size and accuracy of the guns have increased, and it is generally considered that 8,000 to 10,000 yards, will be the distance at



GERMAN 42 CENTIMETER (16½ INS. IN DIAR. X 39½ INS. LONG) GUN SHELL WITH BRITISH 18-POUNDER SHRAPNEL SHELL INSET FOR COMPARISON.

the present time. Some of the later battleships have guns with a longer range than 10,000 yards (notably the 13.5 in. and 15 in. types), but it is doubtful if in the North Sea, even in clear weather, ships could be properly seen when beyond this limit, and it is not at all unlikely that the lower figure of 8,000 yards (or something under five miles), will represent the distances between the capital ships in a naval battle.

A 12-in. gun (50 calibres) would almost certainly penetrate the armor of any British or German warship at 10,000 yards, and it may appear from this that the employment of the 13.5 and 15-in. models is therefore valueless. This would be so were it not for the fact that the weight of the charge in the larger calibre projectiles is much increased, with a corresponding effective destructive value of the shell. The number of rounds that can be discharged is also considerably more in the 13.5 and 15-in. weapons owing to the lower velocity of discharge, and whereas only 150 to 200 shells can be fired with the 12-in. 50-calibre gun, from 400 to 500 are possible with the 13.5-in. and 300 to 400 with the 15-in. type.

ENGINEERING ACHIEVEMENT OF THE WAR.

SIX months after the beginning of the campaign we are all surprised to see how splendidly Britain has risen to the front rank of military powers, having now a trained army easily comparable in total fighting power with the more laboriously collected conscript forces of our Continental friends and enemies. The Grand Fleet has given us time to improvise an army, having raw material of the finest quality and having an unsurpassed engineering industry to carry out its equipment. The general strategy of the allies becomes more obvious as we reckon up the items that constitute our strength in the field and on the ocean and at the same time make allowance for what we were short of at the start and have not yet fully attained.

Our enemy is now firmly held, but when we have properly armed our striking force, our generalship will select the most suitable area for the purpose and will crush the enemy by sheer weight of men and material. It is the engineering trade of the country that is largely responsible for the approach of that decisive period.

Toronto Technical School Equipment.—Contracts for the supply of the bulk of the machine tool equipment called for by the management of the Toronto Technical School have, we understand, been distributed between the A. R. Williams Machinery Co., Toronto; the Canadian Fairbanks-Morse Co., Toronto; the Canada Machinery Corporation, Galt, Ont., and the John Bertram & Sons Co., Dundas, Ont.

FIELD ARTILLERY OF BELLIGERENTS.

Country.	England	France	Russia	Belgium	Germany	Austria
Calibre, in.	3.3	2.95	2.95	2.95	3.03	3
Projectile, pounds	18	15.9	14.3	14.3	15.1	14.7
Muzzle velocity, ft. per sec.	1,600	1,740	1,945	1,630	1,500	1,630
Shots per minute	29	20	20	30	20	25
Max. effective range, yds.	6,300	6,000	6,000	6,000	5,500	6,700
Muzzle energy, ft. tons	320	334	360	258	236	272
Weight of gun and car., lbs.	2,690	2,500	2,300	2,300	2,080	2,350
Number of guns in battery	6	4	8	6	6	6
Rounds per gun with battery	176	312	212	242	126	168

Machining Shrapnel Shell Cases, and the Tools Employed

By F. H. Mayoh

Just as there is a wide distribution of orders for the machining of 18-pounder shrapnel shell cases, in like manner will there be more or less diversity in method and procedure adopted relative to their quality and quantity output as finished products. A thoroughly practical demonstration of how to achieve the desired end profitably is given in accompanying article.

SHRAPNEL shells are of varying size and form to suit the weapons from which they are discharged, and to accord with the ideas of experts of each individual government. As in other spheres of modern mechanical engineering practice these shell products manifest high degree accuracy being of necessity interchangeable as regards classification and the weapon to which they pertain.

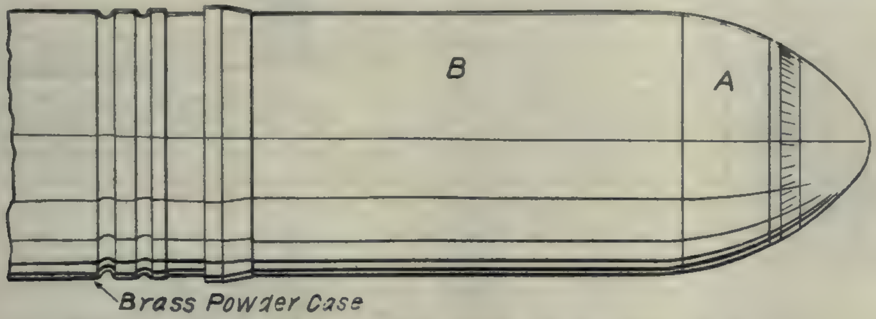


FIG. 1. SHOWING GENERAL APPEARANCE OF SHRAPNEL SHELL.

Taking up first the manufacture of the shell case which contains the various units, reference is made to Fig. 3, which shows a shrapnel shell case in detail, the operations on which consist in making the case complete from a bar or forging.

The operations on this case involve boring the hole, turning the outside, forming the various shapes, grooving and cutting off. All of this is accomplished on different types of standard machines by various arrangements of tools and layouts suitable for the turret lathe.

Fig. 4 illustrates the first operation where A is a bar of steel gripped in a three-jaw lever chuck B. Below and designated as 2nd T.F. are tools which drill two sizes C, turn outside D, rough face end E, cut groove F, and start to cut off G; these tools being held in the turret holes and a turning tool holder bolted to the turret. Following this, the turret slide travels back clear of the work, and the turret indexes bringing another set of tools into position for finishing, the previous set of tools being known as roughing tools. The finishing tools consist of boring tool or reamers which form and bore inside of case H, finish turning tool I, and blade J, which counterbores the end slightly. These tools are held similarly to the roughing-in holders K and L.

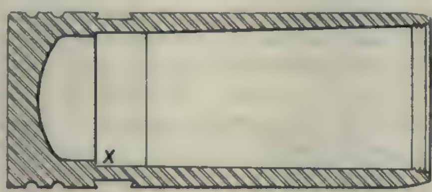


FIG. 3. DETAIL OF SHRAPNEL SHELL CASE.

The turret again indexes and a short thread is cut in end of case by tap held in 4th T.F., while the case is cut off with blade M on rear cross slide. On the 1st T.F., it will be noted that a short drill P is held, the object of this being to spot face the bar of steel, thus making a short hole so that the long drill on the 2nd T.F. will start true. The operations briefly stated are:—Spot face, rough drill two diameters, rough turn, rough face end, cut wide groove, and start to cut off; finish out hole two diameters, counterbore, finish turn, tap and cut-off case.

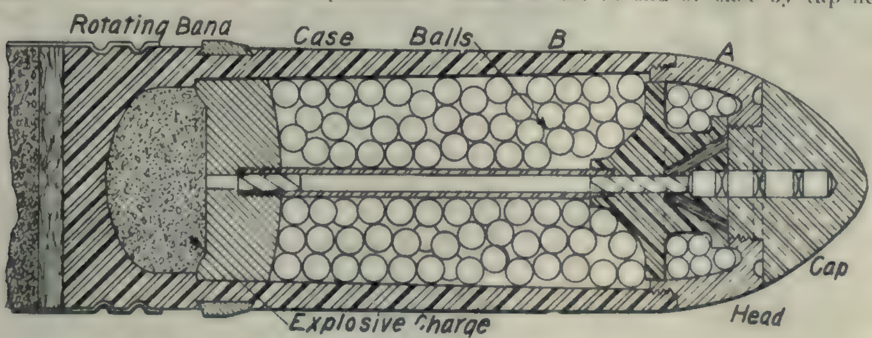


FIG. 2. SECTION THROUGH SHRAPNEL SHELL.

Having completed the bulk of machining on the case we now place it on a suitable arbor in the turret lathe to take the remaining cuts. This arrangement is shown by Fig. 5., from which it will be noticed that the shrapnel shell case slips over the arbor A, fitting on the ring X where counterbored slightly. It is also screwed in the thread a short distance. The closed end of the case is now gripped central by means of the expanding bushing B, which in turn is caused to expand by means of the taper Y and a draw-back rod operated by a hand wheel through the spindle, thus causing the expanding bushing to securely bind the end. The parts to be machined at

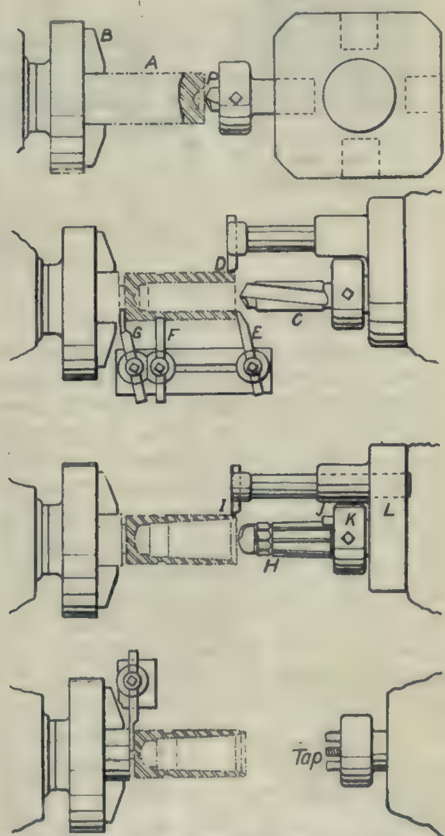


FIG. 4. TOOL SET-UP FOR FIRST OPERATION—FIRST TO FOURTH TURRET FACE.

this setting are the grooves, the curve at the open end and facing the end nearest the turret. For these operations no cutting tools are mounted on the turret, the cross slide being used exclusively for this purpose, although a bracket carrying

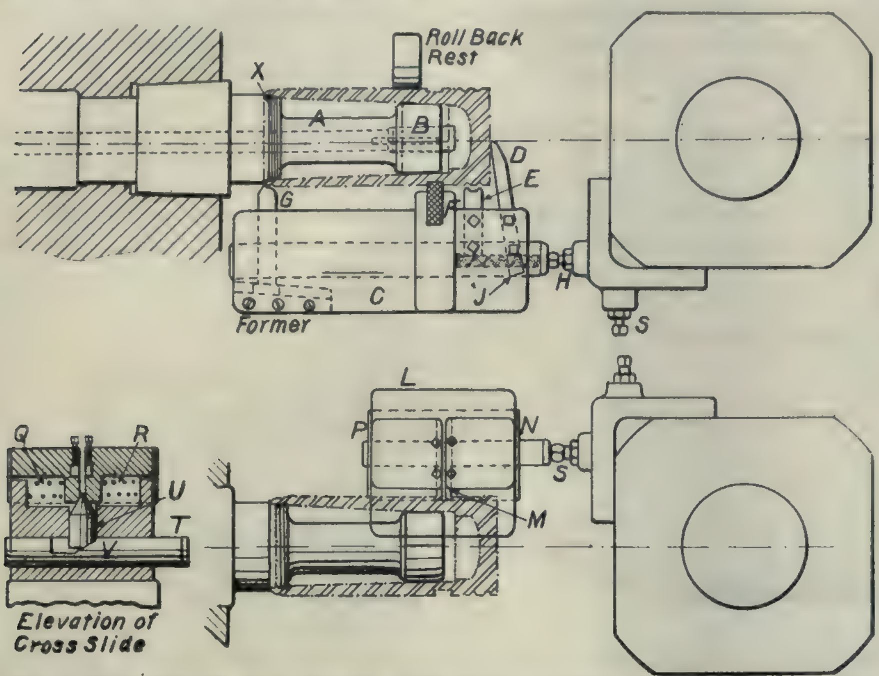


FIG. 5. TOOL SET-UP FOR SECOND OPERATION, FIRST AND SECOND TURRET FACE.

push screws to operate the cross slide tools is mounted on the turret.

Referring to Fig. 5, after gripping the work, the front cross slide block C carrying blades is fed in, the blade D faces the end, a blade or blades E form the grooves, and a roll F knurls the wide groove which was machined in the first operation. At this time, still another blade G, forms the curve at the open end of the case in the following manner:—When the cross slide carrying the tool has fed in the required distance for grooving, it is held in that position by a special cross slide feed lock, while the

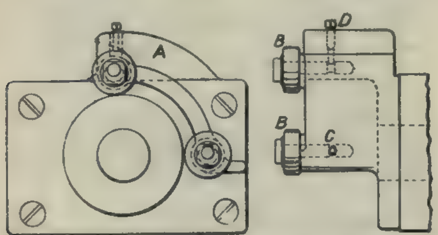


FIG. 6. TYPE OF ROLL REST SUITABLE FOR SUPPORTING CASES.

screw H in a bracket on the turret pushes a bar J through the cross slide block in the direction of the arrow, thus advancing the blade G along a former which conforms to the shape to be cut: this former being inside the cross slide block.

Following this, the turret indexes from the first to second turret face and another block on the rear side of the cross slide L comes forward carrying two blades M, which are held in two separate blocks N and P, which are free to slide in the block at right angles to the movement of the cross slides. As this block comes in, the blades are held close together by means of springs Q and R, thus allowing them to enter the groove previously formed. When the blades reach the bottom of the groove, the cross slide dwells as previously described and the turret comes forward until the screw S in the bracket engages the plunger T. This in turn pushes up plunger U by means of the angular surface V, and plunger U pushes apart the slides N and P by having its point tapered, thus undercutting or dove-tailing the groove to the desired shape.

As the turret returns, the springs push the two slides together, the cross slide returns to its original position and the piece being now complete is removed from the machine. Briefly stated, this second operation is as follows:—Place on arbor, face end, cut grooves, form open end with single point tool, knurl and cut dove-tails.

It will be noticed in Fig. 5, that a roll is shown at Z, this roll being part of a suitable back rest shown in Fig. 6. It consists of a holder A, two rolls B, and two eccentric studs C for holding the rolls, the idea of the eccentric studs be-

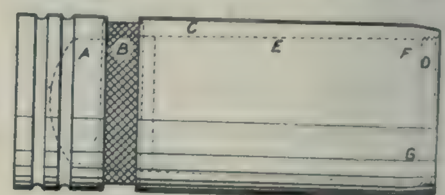


FIG. 7. SHRAPNEL SHELL FOR MACHINING ON SCREW MACHINE.
Operations—Feed stock; rough holes A and B; turn C and groove; finish hole A; counterbore D; ream taper E; tap F; face end G; finish hole B; knurl H; cut-off I.

ing to enable the rolls to be set up to the work by turning them, the eccentric throw acting as an adjustment which carries the rolls in and out against the work, and, when the correct adjustment is obtained, the studs are bound by the screws D.

Machining Forged Shells.

In addition to the methods outlined above for machining, shells are quite often made from forgings, in which case the procedure is very similar. The case is gripped over the outside for the first operation, and the periphery is turned at the second holding; a cutting off tool is of course unnecessary.

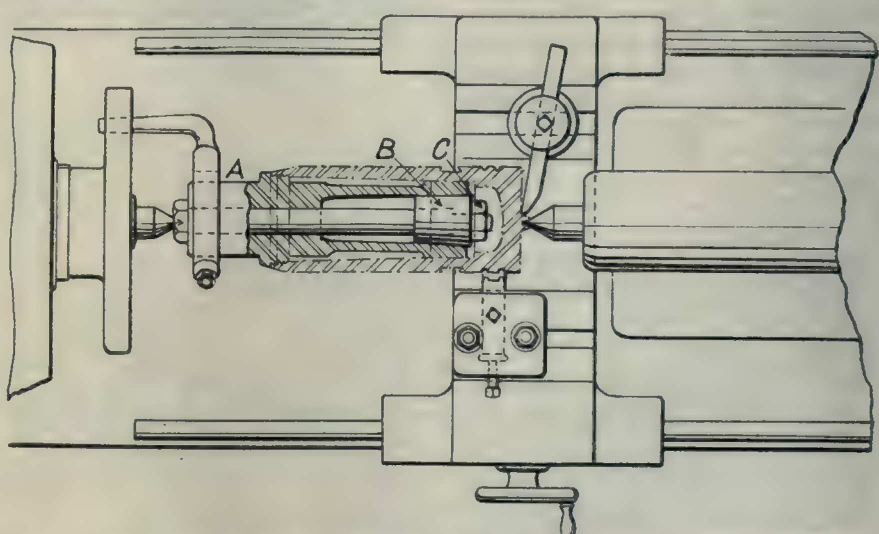


FIG. 8. SET-UP SHOWING ARBOR SUITABLE FOR HANDLING CASES BETWEEN CENTRES.

While it would be impossible to refer here to the many methods in use, most of which vary but slightly from the foregoing on the smaller sizes of shrapnel shells, a screw machine is quite often

used where the operations involved would likely be rough turn outside and face solid end, cut grooves and knurl: this completing the first operation with forged blanks. The second operation detail would be grip on outside diameter with special holder or true running chuck with soft jaws, form and bore hole two cuts; face to length, and tap. In making these pieces from the bar on a screw machine, we would first feed stock against a stop in the first turret hole, rough out hole two sizes, turn and groove, finish formed hole for powder at closed end, counterbore end, ream tapered hole, tap, face end, finish large hole at end of taper X, Fig. 3, knurl and cut off. These operations are plainly marked on the sketch of the case, Fig. 7.

It frequently happens in making up shrapnel shell cases that an engine lathe or some other type of lathe is used. Where it is desirable to swing the work between centers for the second operation, an arbor suitable for the purpose is shown by Fig. 8. This is of the expanding type. The body A, of the arbor is split in three places and is caused to expand by the sleeve B and the tightening of the nut C. In service a dog is placed on the end of the arbor, and with a shell in position as shown, the necessary cuts are taken.

BIG GERMAN GUN A MYTH.

THE stories of the monster German guns that were to bombard the English coast from Calais and other French places do not seem to have upset the naval mind much, and the attitude is a pretty logical one. Guns and gunnery have been the navy's pet subjects for some long time past, and it flatters itself that what it does not know about heavy guns is not worth knowing. When, therefore, it hears of a 16.8-inch gun that will fire a 2,500-pound projectile twenty-eight miles it simply smiles.

A British naval gunnery man deals with the subject thus: "The Germans know everything about our guns that is worth knowing: their extreme range, every foot-ton of muzzle energy they possess, and their muzzle velocity to the fractional part of a foot-second, and they also know that their own naval guns are not so good; that is one of the main reasons why they are sticking in harbor instead of coming out to fight us. Our naval guns are the product of a long course of development; it took years to develop the 50-calibre 12-inch and the modern 13.5-inch was only possible from the experience gained in that development, just as the 15-inch developed from the 13.5-inch.

"Mr. Churchill said of the 15-inch: 'its power may be measured by the fact that whereas the 13.5-inch guns hurls a 1,400-pound projectile, a 15-inch discharges a projectile of nearly a ton in weight, and can hurl this immense mass of metal ten or twelve miles.' Is it possible then to imagine that, if Germany has a gun able to hurl a projectile twenty-eight miles, her navy would be gunned as it is? That Germany may have a 16.8-inch gun firing a projectile of 2,500 pounds no one doubts, but if it can hurl it ten miles that is about the extreme range. So, at least, says the navy, and it should know something about the subject."

SMALL ARMS OF BELLIGERENTS.

NO two of the European armies now engaged in war are equipped with the same rifle. The French and Austrian forces are using the largest calibre instruments found on the Continent, while the latter, at the sacrifice of velocity, is employing the heaviest bullet. The German rifle attains the greatest muzzle velocity, but this is partly on account of the fact that it uses the lighest projectile shot by any small arm in Europe.

The longest rifle in service belongs to the Russian equipment, while the French have the longest bayonet, a thing which gives their weapon the greatest total length and, therefore, an advantage in charging. The shortest gun is that of the British army, and, with the bayonet added, the instrument is still shorter than those of any countries, except Belgium and Austria. Owing to the small size of the gun, however, it may be handled with ease.

The British Arm.

The Lee-Enfield 303-calibre rifle, firing a cupro-nickel bullet weighing 215 grains, with a muzzle velocity of 2,060 feet a second, and using a propelling charge of 31.5 grains of cordite, is used by both infantry and cavalry of the British. Although experiments have recently been conducted with a sharp-pointed projectile, the round-nose bullet is still being used. The weapon is 3 feet 8½ inches in length and takes a sword bayonet 17.2 inches long, which gives it an aggregate length of 5 feet 1.7 inches. Its magazine capacity is 10 cartridges, which is larger than that of any other gun now being used.

The French Arm.

The French troops carry the Lebel magazine rifle of .315 calibre, which fires a pointed bullet with a boat-shaped tail, made of a copper and zinc composition and weighing 198 grains. The propelling charge is 46.2 grains of nitrocellulose powder and hurls the bullet from the rifle with a velocity of 2,380 feet a second. In length the weapon measures 4 feet 3⅛ inches, and its sword bayonet 20.72 inches, giving it a total length of 5 feet 11.84 inches. Including the bayonet the weight of the gun is 10 pounds 1½ ounces, which is greater than that of the arms carried by any of the other troops. The magazine holds five cartridges.

The Russian Arm.

Russian fighting forces are armed with the "three-line" Nagant .30-calibre rifle, which is 4 feet 3⅞ inches long and uses the old-style triangular bayonet of 17.2 inches in length, giving the piece a total length of 5 feet 9 inches. The ammunition carries a propelling charge of about 49 grains of pyroxiline, which shoot a cupro-nickel shell, round-nosed, weighing 214 grains, at a muzzle velocity of 1,985 feet a second. With its bayonet the gun weighs 9 pounds 11¼ ounces, while its magazine capacity is five cartridges.

The Belgian Arm.

A .301-calibre Mauser rifle, firing a round cupro-nickel shell of 219 grains, with a velocity at the muzzle of 2,034 feet a second, is used by the Belgians. The propelling charge consists of 37 grains of nitrocellulose powder. In length the rifle is 4 feet 2¼ inches and its bayonet 9½ inches, which gives it an aggregate length of 4 feet 11.75 inches.

The German Arm.

Germany has a .311-calibre Mauser rifle, which fires a pointed projectile made of nickel-coated steel, weighing 154.5 grains. It uses a propelling charge of 48.4 grains of nitrocellulose powder and throws the bullet at a muzzle velocity of 2,882 feet a second. In length the rifle is 4 feet 1.4 inches, while the bayonet, 20.61 inches long, gives it an aggregate length of 5 feet 10 inches. It weighs 9 pounds 14 ounces.

The Austrian Arm.

Austria-Hungary equips its troops with the Mannlicher rifle of .315-calibre. This fires a round lubricated steel bullet weighing 244 grains, which is sent from the gun at a velocity of 2,034 feet a second by a propelling charge of 42.44 grains of nitrocellulose powder. The weapon is 4 feet 2 inches in length and has a bayonet 9.5 inches long, which gives it a measurement of 4 feet 11.5 inches in length. The magazine capacity of the gun is five cartridges, the same as that of the German Mauser rifle.

Range Features.

The Russian "three-line" Nagant rifle has a maximum effective range of 2,096 yards. The Belgian, French and German rifles fire 2,187 yards effectively. The Austrian weapon has a range of 2,132 yards, and the Lee-enfield rifle of the British forces one of 2,100 yards.

Development of Our Nickel-Copper Smelting Industry

By A. W. G. Wilson.*

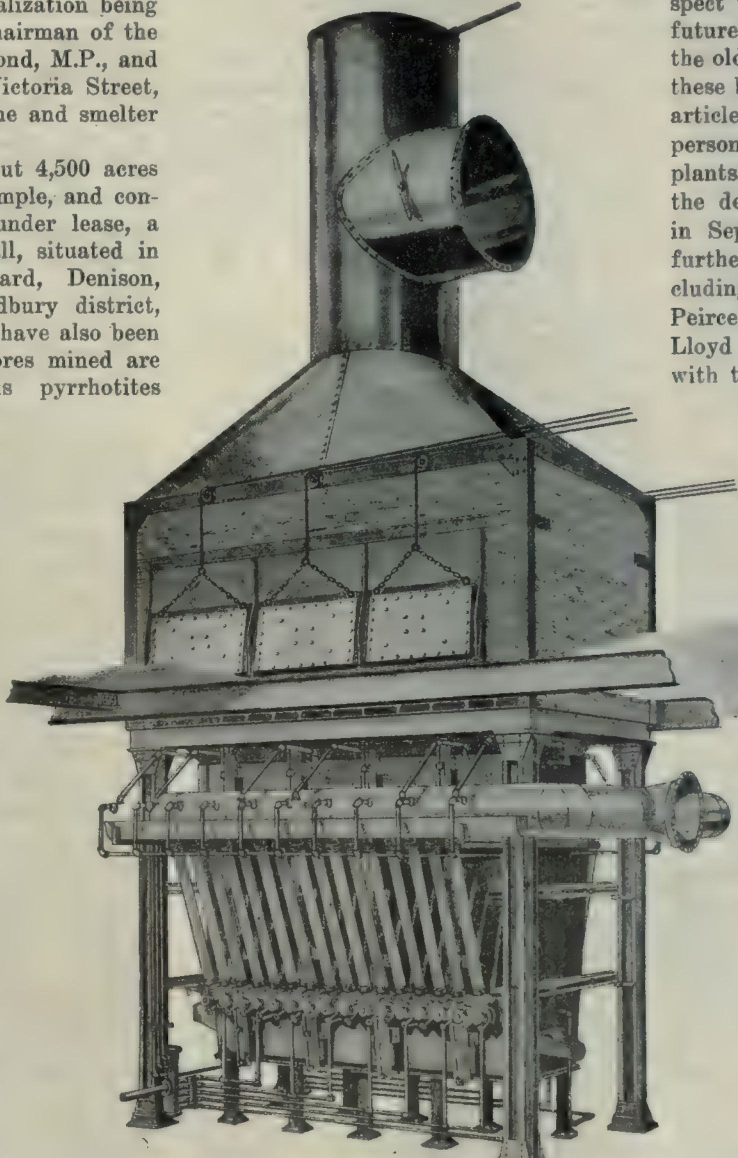
The accompanying article is the third of a monthly series descriptive of Canadian nickel-copper smelting plants. The European War has brought this particular industry very much into the limelight, on which account information relative thereto is of more than ordinary interest and moment. Section 3 of this description of the Mond Nickel Co. organization will deal with the Company's refining plant in Wales. Data and cuts are by courtesy of the Canadian Department of Mines and represent conditions existent in the fall of 1913.

MOND NICKEL CO.—I.

THE Mond Nickel Co. was incorporated September 20, 1900, under the laws of Great Britain, and operates in the Province of Ontario under license. The original capital of £600,000 sterling has been twice increased, the present capitalization being £2,400,000 sterling. The chairman of the company is Sir Alfred Mond, M.P., and the head office is at 39 Victoria Street, London, England. The mine and smelter office is at Coniston, Ont.

The company owns about 4,500 acres of mining lands in fee simple, and controls about 2,500 acres under lease, a total of 7,000 acres in all, situated in the townships of Blezard, Denison, Snyder, and Garson, Sudbury district, Ontario; additional areas have also been acquired recently. The ores mined are deposits of nickeliferous pyrrhotites containing some chalcopyrite, and occurring in norite; they contain about 2.3 per cent. nickel and 1.75 per cent. of copper in addition to small amounts of gold, silver, platinum and palladium. For many years the principal property was the Victoria Mine, first opened about 1890. Two ore bodies, about 160 feet apart, occurred on this property. They lay with their longer horizontal axis almost on an east and west line, and had a uniform dip of about 75° towards the east. Development work was by diamond drilling, followed by shaft sinking and the running of levels. The main shaft is a 3-compartment shaft, 800 feet in depth, 4 ft. x 12 ft. inside the timbers; ten levels have been driven from this shaft to reach ore body.

The other important mine which has supplied ore for a number of years is the Garson. There are two ore bodies at this mine, about 100 feet apart, and the development and mining have been through a 500 ft. shaft. Extensive diamond drill work, based on the results of magnetic surveys, has shown the existence of a large body of ore on property belonging to this company, adjacent to the Frood Mine, Lot 6, Concession VI., Township of McKim. Preparations have been made to mine this ore body on a large scale.



RECTANGULAR WATER-JACKETED COPPER BLAST FURNACE. ORIGINAL TYPE USED BY THE MOND NICKEL CO., 1900, VICTORIA MINES SMELTER (A.C. CO.).

The company also owned and operated a smelter at Victoria Mines, Ontario, on the Soo branch of the Canadian Pacific Railway, about 2 miles from the Victoria Mine, and 22 miles west of Sudbury; but the operation of this plant has now ceased, there having been erected to replace it a modern and fully-equipped plant at Coniston, about 7 miles east of Sudbury. The new plant is more conveniently situated with respect to railway transportation and the future ore supply. Descriptions of both the old and new works are here included, these being based upon several published articles and upon data obtained by a personal visit of the writer to the two plants. Relative to the plant at Coniston, the description represents its condition in September, 1913, since which date further equipment has been added, including another blast furnace, another Peirce-Smith converter, and two Dwight-Lloyd straight line sintering machines with the necessary auxiliary equipment.

The ore supplied for the old plant was conveyed to the roast yards and thence to the smelter over a Bleichert aerial tram line, 11,000 feet in length. Ore from the Garson Mine was brought about 31 miles in 50-ton bottom dump steel railway cars to Victoria Mines; from here a portion was sent to the roast yards over the tram line and the balance went directly to the furnaces. Ore supplies for the new smelter are derived chiefly from the Garson and the Frood Mines, a portion of the ore body of the latter being on the property of this company. The haulage distances to the new roast yards, about a mile and a quarter from the smelter, are 10 and 12 miles respectively, chiefly over the Canadian Northern Railway.

Power for the Victoria Mine and smelter was furnished by a hydro-electric plant, owned by the company, and located at Wabagishik Falls, on the Vermilion River, in Lorne Township, and about 8 miles from Victoria Mines.

*Chief of Metal Mines Division, Ottawa.

Power for the Garson Mine was procured from the lines of the Wahnapitae Power Co., whose two power plants are located on the Wanapitei River not far from Coniston. The new smelter is operated by Wanapitei power.

Historical.

In the year 1899 the company began operations in the Sudbury district by extensive stripping and other development work at the Victoria Mine. This included the building of roads, the preparation of a roast yard and other preliminary work. In 1900 the smelter was erected on its present site, under the supervision of Hiram W. Hixon. The Bleichert tram line, 11,000 feet in length, was installed by the Trenton Iron Co. of New Jersey to connect the mine, roast yards, and smelter. The furnaces were first blown in early in 1901. The mine and smelter were closed down in December, 1902, and were not again in operation, except for a few months in the summer of 1903, until near the end of 1904. Since that date the plant had been in continuous operation, with only slight interruptions. The first furnaces were 44 in. x 120 in. at the tuyères; in 1908 the plant was remodelled and the size of the furnaces increased to 44 in. x 180 in.

In 1911 a site was selected at a point about 2 miles from Romford Junction, on the Canadian Pacific Railway, conveniently located, both with respect to two transcontinental railway lines and to the principal mines owned by the company, and a new modern smelting plant erected. There are now installed three blast furnaces, 50 in. x 240 in., three Peirce-Smith basic converters, 10 ft. x 25 ft. 10 in., together with the necessary auxiliary equipment.

Victoria Mines plant.

This plant, although having ceased operation, has, however, served its purpose well, having been an important factor in the development of the copper-nickel industry of the Sudbury district. A brief description of the equipment and the method of operation is of interest, and may also be of future value as a matter of record.

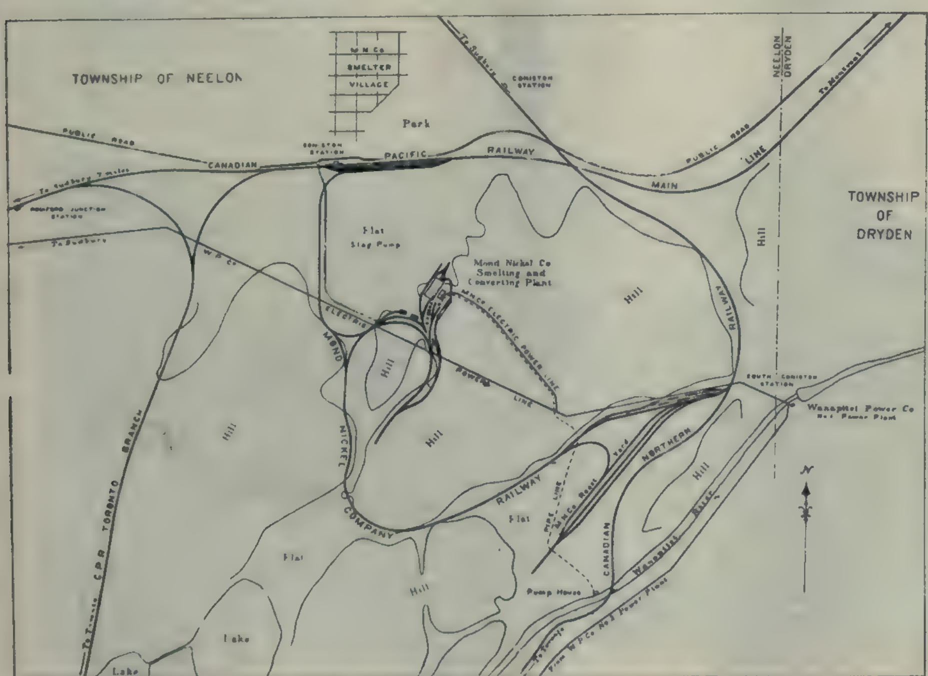
General Statement of Equipment.

The plant was equipped with two water-jacketed blast furnaces, 44 in. x 180 in., each capable of treating 400-450 tons of ore charge per day, under present practice. In converter building were two electrically-operated converter stands, and 6 shells, each 84 in. x 126 in., and a 30-ton, 3-motor, Morgan traveling crane. Power was electric, supplied by the company's plant at Wabagishik Falls, on the Vermilion River, with a boiler plant held in reserve at the smelter. The blower plant included two Connersville blowers and a Nordberg compressor for the converter air. The buildings consisted of office and laboratory, engine house,* well equipped shops, club-house, boarding houses, and about 40 detached dwellings.

GENERAL VIEW OF THE COMPLETED PLANT AT CONISTON. NOTE THE CURVED LINE OF TRESTLES CARRYING THE TRACKS THAT RUN UNDER THE ORE BINS AND ON THE CHARGING FLOOR LEVEL.

Bleichert Tram Line.—This tram line was 11,000 feet in length and ran from the Victoria Mine to the smelter. It was equipped with loading terminals at the mine, at the roast yards, and at the smelter, and with discharging stations at the roast yards and smelter. The buckets each held about 700 pounds and travelled the two miles from the mine to the smelter at such a rate as to deliver about 100 loads per hour. The roast yards were located between the mine and the smelter and about half a mile from the latter. Ore from the Garson Mine was delivered into tram bins near the smelter by Canadian Pacific Railway ore cars; this ore being then raised by a small skip to charging bins on the tram line, whence it was conveyed to bins at the roast yard. The tram line also carried Victoria Mnie ore to the roast yards, roast ore to the smelter, and waste rock from the Victoria Mine to the dump. The operation of the tram line was such that each bucket was idle for only a very short portion of the entire round trip from Victoria Mine to smelter and return.

The difference in elevation between the mine and smelter was only about 160



GROUND PLAN, CONISTON PLANT, MOND NICKEL CO.

*The power plant at Victoria Mines was destroyed by fire on the day before it was closed down for removal to Coniston.

feet, but owing to the heavy duties required of the tram, this fall was not sufficient to operate it, and additional driving power was furnished by a 30 h.p. motor installed at the lower end.

CHARGING FLOOR, SHOWING TOP OF A FURNACE.

Flue System and Stacks.—The downtakes of the blast furnaces led to a steel dust flue with continuous V bottom, and slides were provided on either side at about 4 ft. centres, for the removal of flue dust. The main stack was of steel plate, and about 115 feet in height. The lower part of the stack, about 24 feet in height, was shaped as a truncated cone, the upper portion being cylindrical. The converter flues connected with the main stack.

Buildings.—The smelter building was a steel frame structure, covered with corrugated iron sheeting, while the electrical sub-station, in which the power plant was also placed, was a wooden trussed brick building with concrete floors, 50 ft. x 90 ft. The roof was composite, being covered with corrugated steel on the outside and lined with matched pine. The various shops were housed in wooden structures.

Coke, Fluxes, Silica.—The coke used in the furnaces came from Pennsylvania, being shipped by water to Algoma Mills, 73 miles west of Victoria Mines, where it was loaded into box cars, or coke cars, and hauled to the smelter by the Canadian Pacific Railway. The freight charges amounted to about $5.60 per ton on coke that cost $1.10 per ton at the ovens. Limestone, which forms about 4 per cent. of the furnace charge, was obtained from the Fiborn quarries in Michigan. For converter linings, the siliceous ore from Bruce Mines, Ont., was used. This ore consists largely of quartz carrying about 3 per cent. copper in the form of chalcopyrite. The ore is hauled 121 miles over the Canadian Pacific Railway. When an additional supply of quartz was required, it was obtained from a local quarry not far from the smelter.

Blast Furnaces.—The two furnaces were each 44 in. x 180 in. at the tuyères, and were mounted on concrete foundations at an elevation of 6 feet above the converter floor. The superstructure was of structural steel above the charging floor; the hood, stack, and downtake leading to the flue being of steel plate. They were water-jacketed steel furnaces with brick tops, and cast-iron sole plate 2 in. thick. Their capacity was 400-450 tons of ore charge per 24 hours for each furnace, under the present method of operation.

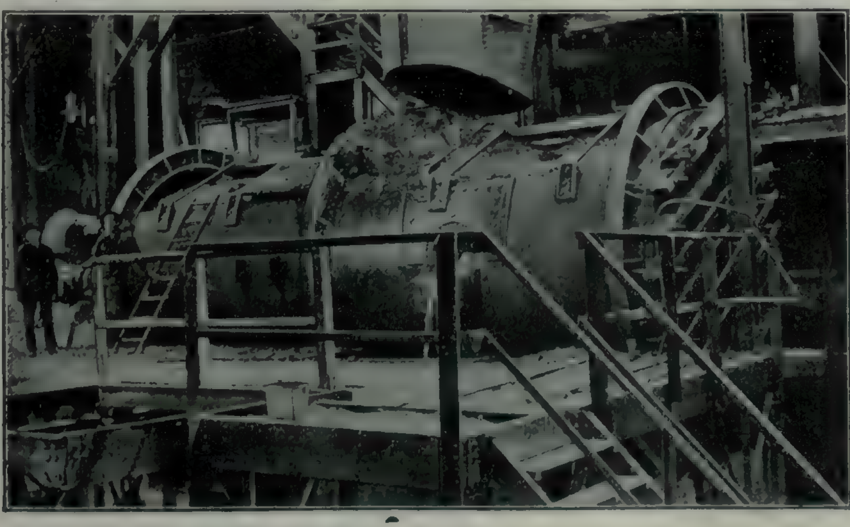
CONISTON PLANT IN COURSE OF ERECTION. MOND NICKEL CO., CONISTON, ONT.

The furnaces as originally constructed each consisted of two tiers of water-jackets, three jackets on each side to each tier. The upper tier had, however, been replaced by brick. The inside brickwork was of firebrick, and the outside of common brick. The furnaces were charged from the side, the charge doors being operated with a pneumatic lift. The charging floor was 14 feet above the tapping floor. The furnaces were provided with special water-cooled cast-iron spouts, each provided with only one set of water pipes, while the spouts were lined with chrome brick, similar brick being also used at the tap holes. The crucible was built within a plate steel box, and carried by the sole plate. Chrome brick laid in magnesite cement was used for this; the magnesite cement being mixed with magnesium sulphate water. The settlers were circular, each 12 feet in diameter and 4 feet in depth.

CONISTON PLANT, SETTLER ON FURNACE FLOOR.

Converters.—There were two electrically-operated converter stands and six Allis-Chalmers improved, 84 in. x 126 in. shells. The stands were operated from a pulpit by individual controllers and air valves, while the converter shells and 5-ton cast steel matte ladles were handled by one 30-ton 3-motor Morgan travelling crane. Lining for the converters was prepared by a 7 in. x 10 in. Blake crusher, and two 6 ft. Chilian mills direct connected to a 30 h.p. direct current motor.

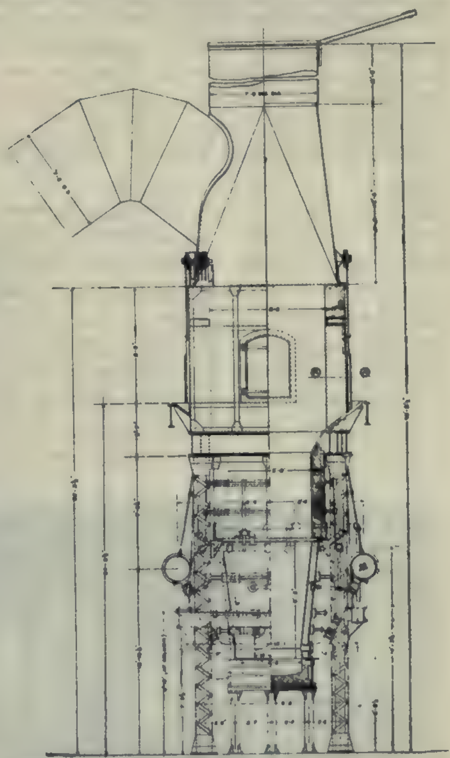
Blower Plant.—Air for the blast furnaces was supplied by two Connersville blowers, each having a capacity of 15,340 cubic feet of air per minute at 40 ounces pressure, running at 130 r.p.m. Each of these was belt-connected to a 200 h.p. constant speed motor, taking current at 550 volts, and running at 580 r.p.m. The air pressure at the furnaces was about 38 ounces. Air from the blowers was delivered to a common receiver, and conducted to the bustle pipes of the furnaces. Bustle pipes ran along each side of each furnace and across one end.



CONVERTER IN OPERATION, CONISTON PLANT.

Air for the converters was supplied by a Nordberg duplex air-compressor, capacity 6,000 cubic feet of free air per minute, compressed to 12 pounds pressure, at 82 r.p.m. The low pressure cylinder was 34 in. in diameter, and the stroke 42 in. The flywheel was 18 feet in diameter, and grooved for 18 ropes each 1.25 in. in diameter. The machine was driven by a constant speed 315 h.p. induction motor running at 345 r.p.m., receiving current at 550 volts. This blowing engine was fitted with mechanical inlet Corliss valves and poppet discharge, and was regulated by the air pressure from the receiver through floating levers to the governor, this controlling the cut-off on the Corliss inlet-valves.

Flue Dust.—Flue dust was drawn from the flue through the slide doors into a barrow. It was wetted and fed to the furnace from hand barrows.



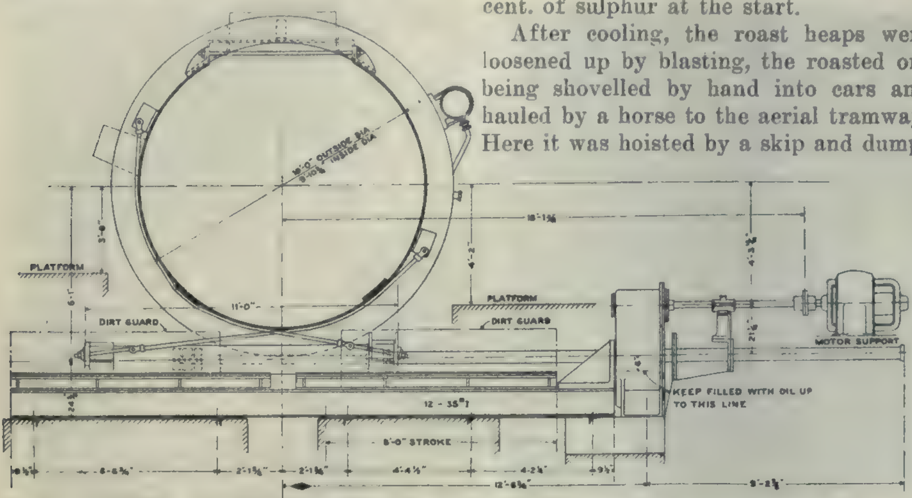
VERTICAL TRANSVERSE SECTION OF COPPER BLAST FURNACE (A.C. CO.). 1912. MOND NICKEL CO.

Smelting Practice. Roasting.—About two-thirds of the ore treated was first sent to the roast yards, about half a mile from the smelter and north of Victoria Mines station. Green ore was received at the tramway unloading station in the roast yards and dumped in a pile. Here it was shovelled into buckets and hoisted to the level of the staging built over the roast yards, and loaded into end-dumping hand lorries, holding about 1,000 pounds each, these being pushed by hand to the roast piles. Each roast pile, when completed, contained about 3,000 tons of ore and covered an area of 40 ft. x 150 ft., the piles being built in a row, with the longer axis parallel, and

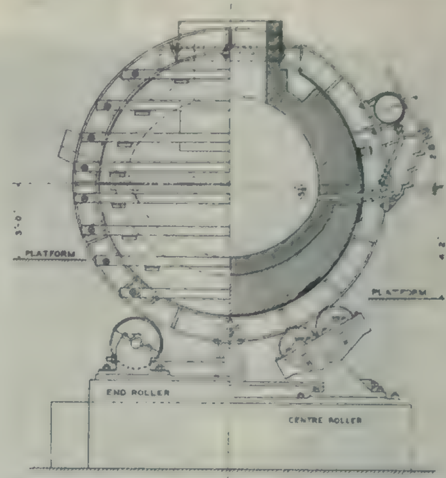
about 10 feet between piles. To build a new pile a light pole staging was erected over the roast bed, and rails were laid in this staging to accommodate the lorries. A bed of dry wood, about 3 feet in depth, carefully and properly piled, was then laid as a base for the proposed roast pile. Upon this wood ore was piled to a depth of about 10 feet. A top dressing of 8 in.-10 in. of fine ore was then spread over the top of the pile and down the sides and ends. The rails and stringers of the staging were afterwards removed, the poles being left standing in the pile. The wood of the pile was next ignited; the whole being alight in about four days. The pile was carefully watched, blow holes being stopped whenever they appeared, and the roast continued for about 100 days, by which time about half the sulphur had been burned out, the green ore containing about 20 per cent. of sulphur at the start.

After cooling, the roast heaps were loosened up by blasting, the roasted ore being shovelled by hand into cars and hauled by a horse to the aerial tramway. Here it was hoisted by a skip and dumped into the loading bins. Three men were required at the hoist in the roast yards; two men were required on each lorry; about 15 men in all being employed in these yards. The average output of the yards per day was approximately 475 tons of roasted ore, when the plant was operating at full capacity. All ore from the Victoria Mine was weighed into the roast yards at the mine, and that from the Garson Mine was weighed at smelter before being sent to yards. All roasted ore was weighed out of yards.

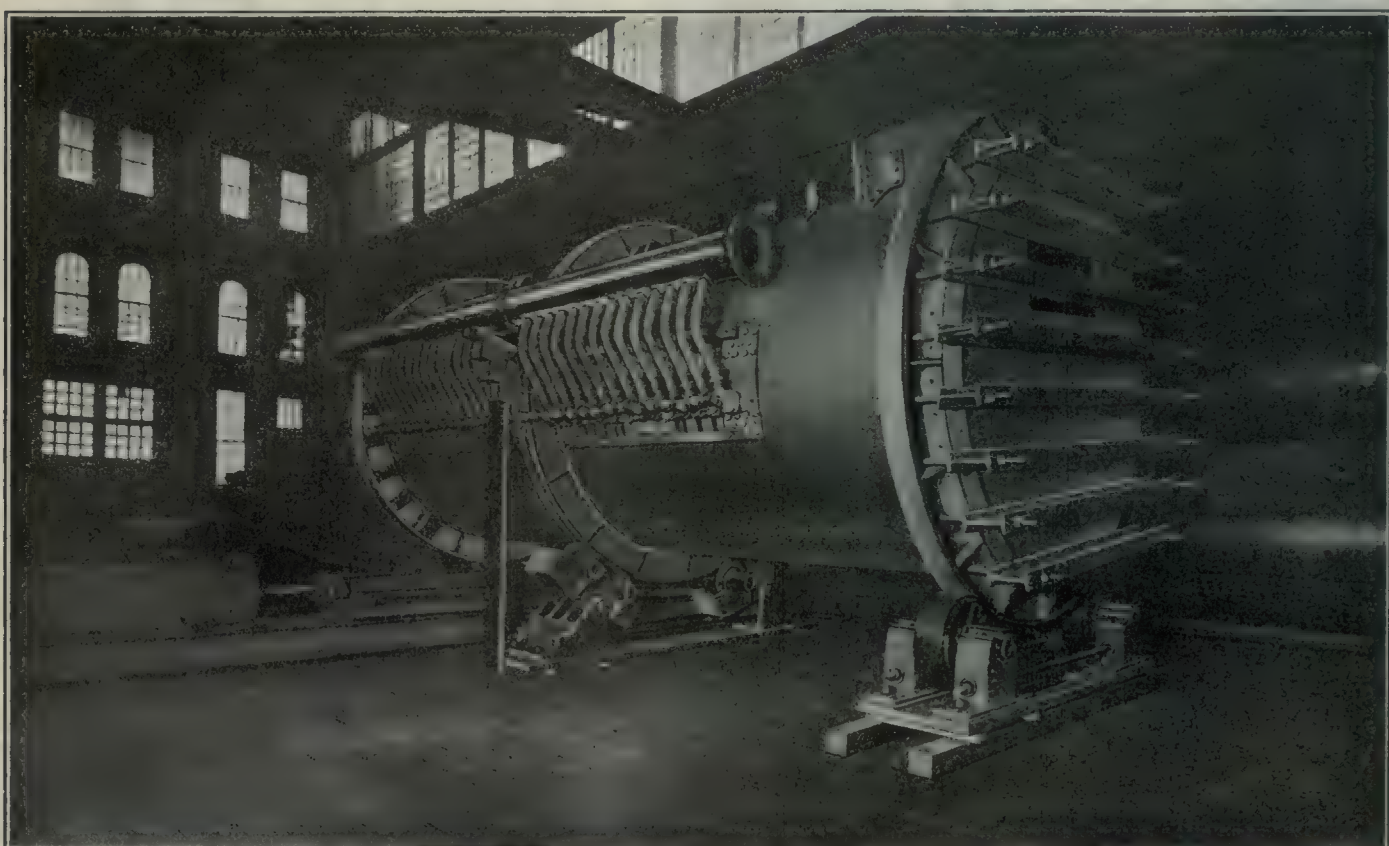
Smelting.—At the smelter, ore, coke, and fluxes were all stored in bins placed with their discharge chutes above the level of the charging floor, so that the charge barrows would be run beneath them. The furnaces were charged by hand lorries holding about 800 pounds each. The ore charge consisted of two parts roasted ore to one part of green ore; the coke making up about 8 per cent. of the whole charge. A typical charge consisted of about 1,200 pounds



BASIC COPPER CONVERTER, PEIRCE-SMITH TYPE, MOND NICKEL CO. TRANSVERSE SECTION SHOWING ATTACHMENT OF TILTING MECHANISM (A.C. CO.).



BASIC COPPER CONVERTER, PEIRCE-SMITH TYPE, MOND NICKEL CO., TRANSVERSE SECTION THROUGH WIND BOX AND TUYERE ON RING NEAREST THE TILTING MECHANISM (A.C. CO.).



PEIRCE-SMITH BASIC COPPER CONVERTER, CONISTON PLANT, MOND NICKEL CO.

of roasted ore, 600 pounds of green ore, 300 pounds of scrap and slag, including 75 pounds of limestone and 250 pounds of coke. The practice was to granulate the furnace slag, which was then flushed out to the edge of the dump.

Converting.—The furnace matte, containing about 33 per cent. copper and nickel, was collected in the settlers, which were tapped at intervals. From the settlers furnace matte was run into pots, which were lifted by the travelling crane and charged directly into the converters. Matte from No. 1 converter was blown up to about 60 per cent. copper-nickel. It was then skimmed and the slag sent to the furnace settler while still hot and liquid. The matte from converter No. 1 was then charged to converter No. 2, and blown to about 80 per cent. copper-nickel. The slag from this converter also went to the furnace settler, and the matte run into a pot, from which it was poured on a matte bed to cool. There were four of these matte beds, each 4 ft. x 15 ft. It was customary to draw matte from the settlers at the same time as converter slag was being poured, thus preventing the overloading of the granulating streams.

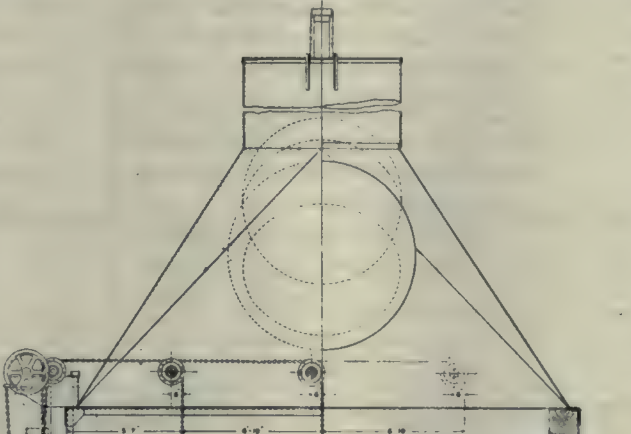
The final Bessemer matte produced contained about 38 per cent. copper and 42 per cent. nickel, and about 15 per cent. iron, the balance being sulphur and other impurities. It was broken up on the beds, put into barrels, and shipped to the Mond Company refining works at Swansea, Wales.

Coniston Plant.

The site for the new plant at Coniston was chosen only after very careful surveys. The new smelter is located on a rocky hillside overlooking a large swampy flat, which gives ample storage room for large slag piles. The general layout of the plant and the railway approaches are shown on page 42.

The roast yards are located about three-fourths of a mile from the smelter, to the south-east, on the other side of the ridge at whose foot the smelter is placed. They are connected directly with the Canadian Northern and the Canadian Pacific Railways, and are also connected with the smelter by a spur line belonging to the company. A new townsite has been selected and laid out, north of the Canadian Pacific line and about one mile from the smelter. Coniston will be a model town provided with every modern convenience available.

General Statement of Equipment.—The main smelter building has a concrete substructure resting on bed-rock, and a structural steel super-structure. In this building are placed two new modern water-jacketed blast furnaces, 50 in. x 240 in., and two Pierce-Smith basic converters, 10 ft. x 25 ft. 10 in. Provision has been made for an additional blast furnace, which will be added when required. The power building is located on the hill above the smelter. The ore bins are placed beyond this and a rock house stands south-east of the smelter and over the lower tracks. A semi-circular track leads from beneath the ore bins to the charging floor of the smelter building. It is carried over the slag tracks on steel trestles resting on concrete piers.



COPPER BLAST FURNACE, 1912, MOND NICKEL CO. VERTICAL LONGITUDINAL SECTION (A.C. CO.).

Receiving Ores.—As shown on page 42, spur lines have been built connecting both the Canadian Pacific and the Canadian Northern Railways with the roast-yards, the smelter yards, and the smelter ore bins. Ore from the mines to the north comes into the roast yards over the tracks of the Canadian Northern Railway and is delivered directly to the yards, or shunted over the company's spur line to the smelter bins. Ores from the west are diverted to the Mond Nickel Company's spur line at Coniston station, and can be run either to the smelter bins or on to the roast yards. Ore from the roast yards can also be conveyed over the spur line to the smelter bins on the high line above the smelter.

Power.—Power to operate the plant is entirely electric and is obtained from the power lines of the Wahnapitae Power Co. This corporation has two power stations on the Wanapitei River not far from Coniston.

Buildings.—The main smelter building is of steel construction with a concrete substructure, 90 ft. x 360 ft., resting upon solid rock; there is a monitor on the roof running the length of the building. A lean-to shed, 21 ft. x 240 ft., on the north-west side, houses the converter plant; a similar lean-to on the south-east, about 30 ft. x 210 ft., covers the slag track and the main flue.

A slag cut on the south-east side is provided with a standard gauge track. The tapping floor is 14 feet higher, and the charging floor 24 ft. 2½ in. above this. The furnace platform is 24 feet in width and 210 feet in length. The matte floor on the north-west side is 10 feet below the level of the furnace floor and about 56 feet in width.

The power house, built on the hill south-east of the smelter, is a brick and steel structure with concrete foundation and a tile roof.

Flue System and Stacks.—The main flue is rectangular in cross-section, 10 ft. x 15 ft., built of sheet steel. It leads to a dust chamber 30 ft. x 50 ft., built of stack brick, which connects with the base of the stack. The main stack rests on bed-rock. The lower 25 feet of the stack is square in section and is built of red brick, the upper cylindrical portion, about 16 feet in diameter, being built of Custodis stack brick. The height is about 175 feet.

Montreal Ammunition Co. has been incorporated at Ottawa, Ont., with a capital of $300,000, to carry on the business of manufacturers of ammunition, shells, bombs, etc., at Montreal, Que. Incorporators—E. E. Howard, J. DeWitt and H. C. McNeil, all of Montreal, Que.

Manufacturing 18 Pounder Shrapnel Shells in Canada*

By John Preston**

The accompanying article deals specially with the production of the British pattern 18-pounder shrapnel shell, and consists of an outline description of the procedure adopted in forging the shell case as well as that of the s bsequent machining operations. Reference is also made to the production of the shell cartridge case by Canadian concerns.

THE majority of the "Made-in-Canada" shells are 18 pounders, and the following description will refer particularly to those of this size. In general this ammunition consists of a drawn brass cartridge case filled with a high explosive, and to the open end of the cartridge is fixed a bullet-shaped hollow steel case, usually referred to as the shell.

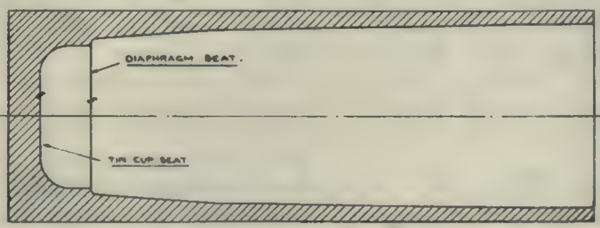


FIG. 1. THE 18-POUNDER SHELL FORGING.

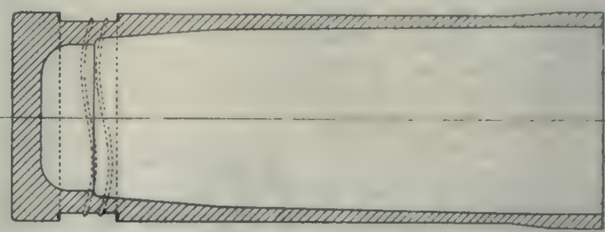


FIG. 2. THE 18-POUNDER SHELL PARTLY MACHINED.

By referring to Fig. 3, it will be noted the shell contains a charge of high explosive powder, A, segregated in a tin case with a sealed cover, B, and held in place by a steel diaphragm C. Ahead of the diaphragm the shell contains a number of lead bullets held in position with resin. A brass tube in the centre of the shell E is for the purpose of holding an extension of the time fuse, which consists of slow-burning powder F. It forms a passage for this fuse between the explosive charge and the detonator or time fuse at the nose of the projectile.

The brass tube is screwed into the steel diaphragm at one end and fitted into and soldered to a brass socket, G, which is screwed into the nose of the shell and also threaded to receive the time fuse and detonator. The explosive charge in the cartridge gives the shell a velocity of about 1,600 ft. per second at the muzzle, and the shell is effective for ranges of approximately 8,000 yards. The minimum range at which the shell may be exploded with the time fuse is, say, 100 yards, and this may be extended up to the full range of the gun. The time fuse is ignited by the gases from the explosion of the propelling charg ·, but, should the time fuse fail, the shell will be exploded on impact through the action of the detonator. The explosion of the charge in the base of the shell gives additional velocity to the bullets in a forward direction, and they are scattered over an area of considerable width.

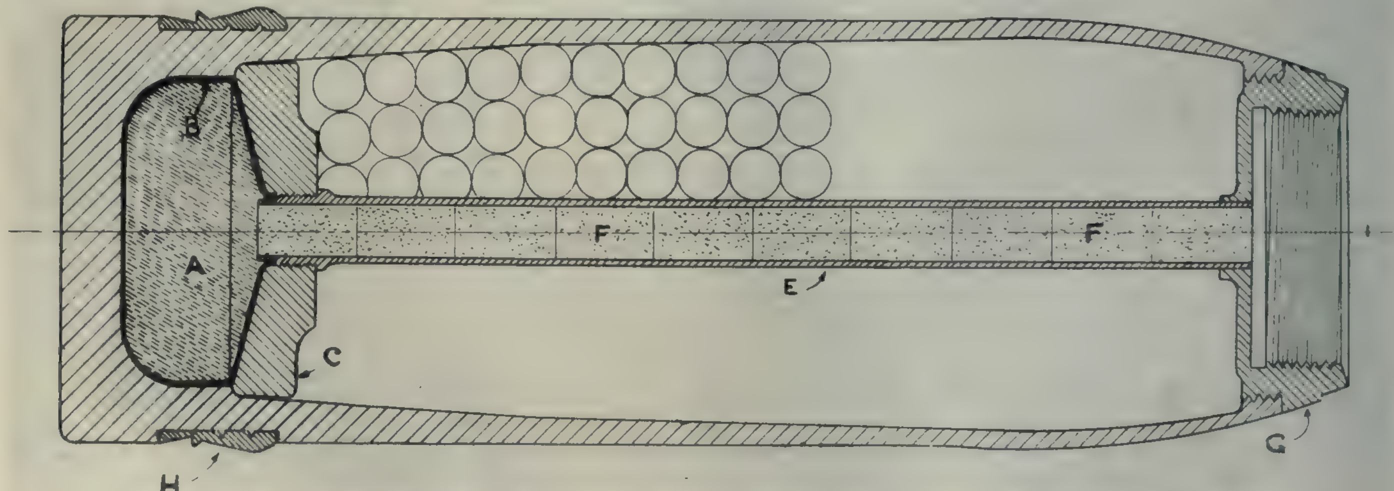


FIG. 3. SECTION THROUGH "MADE IN CANADA" 18-POUNDER SHELL ILLUSTRATING MAKE-UP DETAIL.

Production Features.

In proceeding with the manufacture of these shells, 3½ in. round steel bars of suitable carbon content are selected, the specification providing that the steel after being annealed by heating to 1,700-1,800 degrees F., and cooled in powdered charcoal, shall pass the following physical tests:

(a)—Yielding stress—not less than 42,560 lbs. per square inch.

(b)—Ultimate tensile strength—not less than 78,400 lbs. per square inch.

(c)—Elongation—not less than 20 per cent. in a test piece 2 inches long and 0.564 inch diameter.

Forging blanks are prepared in lengths of 4½ in. by 3½ in. by cutting off the bars individually to the desired length in rotary bar parting machines or sawing off a number of pieces at a time by a cold saw fitted with special attachments for this purpose.

The forging of the shell is done in a hydraulic press of at least 300 tons pressure and having a stroke a little over thrice the length of the shell. It is advisable to have at least two presses and two heating furnaces so that the process of punching and drawing of the shells may be continuous. After heating the blanks in the first furnace, they are placed in a die and the first punching operation is proceeded with. This consists of forcing a round-nosed punch

*Courtesy "Industrial Canada."

**Supt. Ordnance Dept., Nova Scotia Steel & Coal Co., New Glasgow, N.S.

having a diameter of about 3 inches into the blank to within about $1\frac{1}{2}$ inches of the bottom. On account of the die holding the forging to the original diameter of the blank, the metal is forced upward around the punch so that when finished the forging has a length of approximately 8 inches.

After reheating, the punched blank is taken to the second press and fitted with a punch to the exact profile of finished forged inside dimensions of the shell. The forging is then placed over a die having an enclosed bottom, and forced against the die bottom with a punch and the tin cup and diaphragm seat formed. After reversing the press, this bottoming die is removed and the forging is forced through an open die which draws the shell to the proper outside diameter and length, the forging at this stage taking the form shown in Fig. 1, except that the ends are not trimmed. After this, the forgings are annealed and are then ready for the first machining operations. The usual practice is to part off the open end of the shell in a rotary bar-parting machine and face off the base in an engine lathe, or do these operations simultaneously in a cold saw equipped with a saw for parting and a milling cutter for trimming the base, the latter process being somewhat cheaper, as several shells may be trimmed at a time.

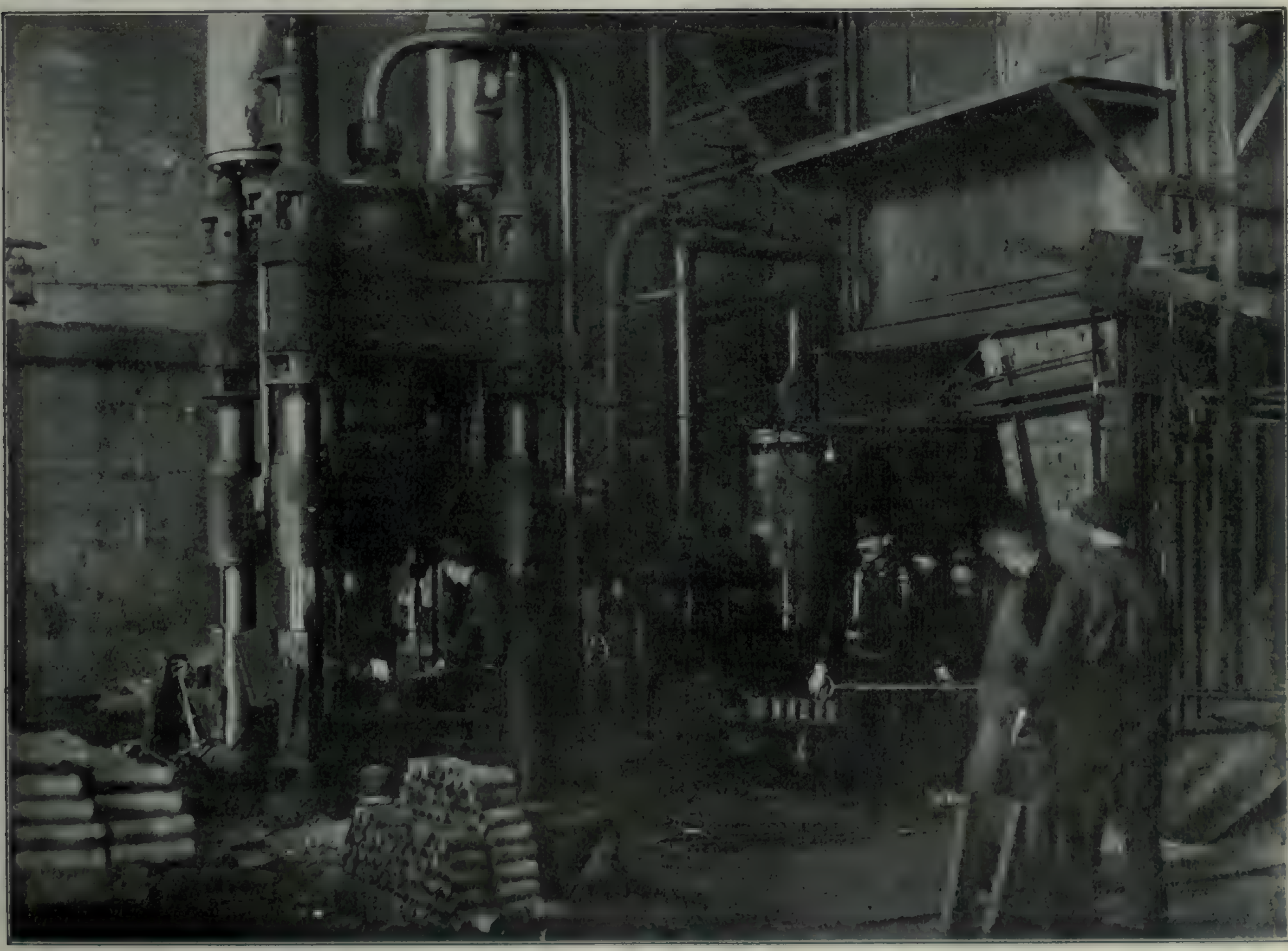
The second operation consists of rough turning the outside of the body and finishing the base and body up to the copper band groove, as shown in Fig. 2. This is invariably done in a hollow spindle lathe having a turret and fitted with an adjustable mandrel on which the shell is centred, so that the outside turning is maintained concentric with the inside forged surfaces. As it is necessary to have additional driving power over that furnished by the mandrel, the shell is gripped from the inside with a chuck and also driven by a clamp from the outside.

In some cases the groove and wave ribs for holding the copper band are also turned in this lathe, taking in consequence three independent operations to perform, while others do it on a separate lathe fited up with attachments to do the three operations simultaneously. The groove and wave ribs are shown at A in Fig. 2.

The third operation consists of finishing the inside for the tin cup and diaphragm seat, this usually being done with roughing and finishing cutters. The part of the shell left unfinished on the outside in the second operation is now completed, making it ready to proceed with either the groove turning, if this were not completed in the second operation, or the heat treatment, usually referred to as the fifth operation. This

SHELL MANUFACTURE.

A point of interest to our business community, and the people of Canada generally, is that, until the outbreak of this war, with the exception of the Dominion Arsenal in Quebec, not one factory in Canada had ever made a shell. The result of the action of the Minister of Militia and the committee he has formed has been to initiate a great organized business industry in the form of shell manufacture. Canada has in this industry one of her strongest assets during war time.



18-POUNDER STEEL SHELL BLANKS BEING FORGED BY AN HYDRAULIC PRESS AT PLANT OF NOVA SCOTIA STEEL & COAL CO., NEW GLASGOW, N.S.

treatment consists of heating the shell to a temperature depending on the carbon content and cooling in a tempering oil. The heating may be done in a regular heating furnace of the direct flame-heating type, using a flame having a reducing action or a furnace of the muffle type, which is preferable, or in a molten lead bath, the advantages of the latter being even heating and perfect exclusion of air from the piece being treated. They also heat quickly, consequently no burning out of the surface carbon is liable to take place. Lead bath furnaces being easily controlled will usually give more uniform results with less experienced furnace men.

In the latter method it is necessary to weight the shells to prevent them from floating, and it is advisable to arrange the lead pot so that the shells will maintain a stationary position. The heating is usually carried to a temperature of about 1,560° F., and after plunging in oil they are drawn at a temperature of about 900° F.

shells are harder than is necessary to give the required tensile tests; but the method so far is not much used.

The eleventh operation consists of pressing on the copper band H, Fig. 3. This is made from annealed copper tubing of sufficient size to slip over the butt end. It is usual to press the copper band into the groove with a special hydraulic press having six or more cylinders, the rams of which are fitted with hardened steel dies of the proper curvature to insure a close fit of the copper against the steel. For shells of this size it requires a pressure of from 30 to 40 tons to get the required results. It is important in this operation that the groove be quite free from oil scale or other foreign matter to insure proper contact. After this is completed, the band is turned to the correct shape by first roughing, and then finishing with a profiled cutter, thus completing the eleventh operation.

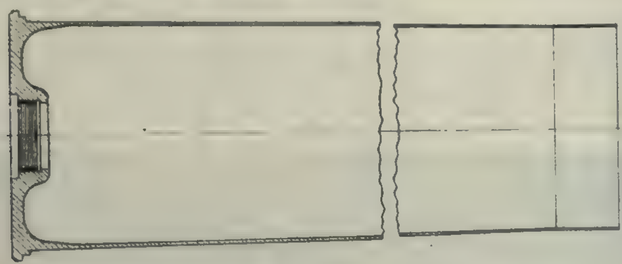


FIG. 4. CARTRIDGE CASE, 18-POUNDER SHELL.

Step			[illegible]	[illegible] Strokes Per Minute	[illegible]	[illegible]	[illegible]	[illegible]	
A	Press DG 56 [illegible]		7	30	Cut & Cup	9600	14500	15	
B	Press DG 56 [illegible]		15	12	[illegible] Drawing	4800	21000	16	
C	Press DG 56 [illegible]		20	12	[illegible] Drawing	4800	21000	20	
D	Press [illegible]		2	60	[illegible]	4800	4400	5	
E	Press D45 Double Ended		40	3	[illegible]	2900	16000	40	
F	Press D45 Double Ended		40	3	[illegible]	2900	16000	40	
G	Press E56		2	20	[illegible] & [illegible]	4800	36000	25	
H	Press DG 35 [illegible]		31	12	[illegible]	2800	18000	10	

FIG. 5. DATA SHEET FOR CARTRIDGE CASES.

The shell is now ready for filling, and this is completed with the exception of the bursting charge. The shell diaphragm having been inserted previous to the nosing operation, it is possible to push the tin cup past the diaphragm to its proper seat, after which the diaphragm is pressed solidly into position and gauged for location. The brass tube E, Fig. 3, is then screwed into the diaphragm and maintained in alignment by a centering gauge, while the bullets are packed in position. The bullets are a composition of lead and antimony, and it is required that the shell contain at least 375, and their weight must amount to 9 lbs. $1\frac{3}{4}$ ozs. The adjustment of weight is obtained by the addition of not more than three or four buckshot. In order to prevent a movement of the bullets, which would destroy the balance of the projectile, the interior of the shell, after the bullets are included, is filled with melted resin, which hardens on cooling.

After the brass nose socket is screwed into place and the tube soldered where it passes through it, the nose is turned to correct shape in the twelfth operation. This is usually done in a lathe of the turret type with two profile tools. In this operation it is necessary to guard against the possibility of solder entering the brass tube or thread of the nose, taps and reamers being used to remove the solder should it be necessary.

During the process of forging and all machine operations, the shell is subject to inspection by Government inspectors, and following the twelfth operation there is a final overall inspection for defects in machining and weight. Following this, the shells are stamped, showing the size, date of manufacture, serial lot number, and manufacturer's name or trade mark. In doing this, it is usual to have a stamping machine, which greatly reduces the time of doing this work. The shells are then painted all over and again painted near the nose with some distinguishing mark, frequently in the form of a band in order to quickly distinguish the particular type of shell from all others of the same size, but different pattern. The body painting and painting of nose, when colored band is used, may be done to advantage in a small lathe and the shells placed in a heated oven to assure quick drying.

Following this, a brass plug is screwed into the brass nose socket to protect it against injury in shipping, the plug being removed when it is necessary to fill the shell with the explosive charge, and afterwards again removed when the time fuse is inserted immediately before firing. Where an order for shells only is in hand, this completes the work, and they are ready to be packed for shipment.

Specially prepared iron-bound wooden boxes are made up to accommodate six shells packed in a manner that will prevent all injury. The box is supplied with a cover, and a handle at each end gives means of easy movement. Should an order be received for fixed ammunition it is also necessary to supply the drawn brass cartridge, complete with detonator and explosive, and attach the shell to the cartridge.

In order to facilitate the drawing of the cartridge case it is usual to use an equipment of about eight presses, the

The sixth operation consists of nosing the shell, that is altering the shape of the open end in a die from the form shown in Fig. 2 to that in Fig. 3. This is done by heating the nose for a distance of about $2\frac{1}{2}$ in. in a lead bath, and after forming in a die, it is reheated at this point and annealed.

The seventh operation consists of turning the inside and outside of the nose and threading it to receive the brass plug. This is done in a lathe of the turret type, the boring and outside turning of nose being done on a forming attachment. The tapping may be done with a collapsible tap, but even with a solid tap it is necessary afterwards to tap out with a hand tap on account of the very narrow limits allowed on the threads.

The steel shell is now ready to be finished to final dimension on the outside, and this may be done in two operations, usually known as the eighth and ninth. This work may be done on two lathes, using one for turning the shell body and the other having a forming attachment is used for the nose.

An alternative arrangement is to finish this portion of the shell in a wet grinder, it having the advantage of greater outputs, particularly where the

circular blank being gradually drawn into shape as it is worked through each press. Table in Fig. 5 shows a balanced equipment capable of turning out 2,700 cases in eight hours.

After the final pass is completed the dimensions of the shell barrel are correct for both inside and outside sizes, but it is necessary to machine both the inside and outside of the base in order to give it the proper shape at this point. After doing this, the shell is bored out and turned on the base and tapped to receive the detonator.

The brass cartridge cases are usually sent to the fixing plant of the manufacturer of the explosive to be charged, the shell inserted and secured—the combined cartridge case and shell tested as to correct length, etc., and assembled at some central point.

It is found in practice that the cartridge cases may be used several times in service before becoming sufficiently deformed that they are useless, so that it is usual when ordering fixed ammunition to order at least twice as many additional shells.

MACHINE GUN FEATURES.

THE basic idea of a multiple or rapid fire gun of the class now generally known as machine guns is probably as old as the history of guns themselves. There is an old Chinese double-barreled gun in existence which, according to the inscription, was made in 1607, each barrel of which is provided with three vent holes so spaced that there is room for a charge of powder and a bullet between each vent. By this arrangement three shots could be rapidly discharged from each barrel, thus constituting a true rapid fire gun.

Since the time of this weapon many devices having the same object have been designed; but the first weapon that proved actually practical was the multi-barreled gun invented in America during the civil war by Dr. Gatling. This gun was operated by hand power, and was capable, in its improved form, of firing over a thousand shots a minute. It may be remarked that the original French mitrailleuse, so often referred to, was never very successful.

The modern machine gun has but a single barrel, and is, in its most improved form, entirely automatic in its action; that is, after the first shot has been fired it will continue to fire at a very rapid rate, all of the necessary operations of loading and firing being worked by either the recoil or by the pressure of the exploding gases within the barrel. While guns of the semi-automatic type have been made in fairly large sizes, the true machine gun is an automatic gun built to take only the regular service rifle cartridge used by the troops; and these guns operate at speeds of from 400 to about 1,000 shots a minute, depending largely on the size of the charge of explosive in the cartridge.

BIG GUNS.

THE early stages of the military campaign in Europe demonstrated conclusively that the big gun was to play an important part in the contest for supremacy on land; and the minor conflicts at sea have shown that the same principle holds good there.

It is a noteworthy fact that the Germans did not pay particular attention to the development of guns of very large calibre for naval purposes, until just previous to the commencemnet of the war. Apparently they were quite satisfied with their 11 and 12-inch weapons, but in 1913 their ideas underwent a big change, and the vessels laid down in that year were to be fitted with 15-inch weapons, so that by 1918 Germany would have possessed a full division of ships armed with the new weapon. This gun was only produced by Krupp's after a series of failures, and after insistent demands by the big-gun school.

The heavy gun has proved its superiority, says the Liverpool Journal of Commerce, but Germany now finds herself in a position of hopeless inferiority from the ordnance point of view. Against Britain's 12-inch, 13.5-inch and 15-inch weapons the enemy can only reply with a large number of 11-inch and a few 12-inch guns. Size of gun is, however, not the only factor, for the method of manufacture is altogether different in the two countries.

The German gun is made by shrinking a number of cylindrical layers on top of each other, while the British guns are known as wire wound, that is, a number of the layers are replaced by winding on miles of wire. The Germans have held to their special type, because they considered that our weapons lacked longitudinal strength. This, however, is one of the many points which this war should definitely settle.

CANADIAN SHELL COMMITTEE.

The personnel of the committee entrusted with the placing of orders for shells, etc., and the inspection and shipment of same is representative of both Canadian military and manufacturing interests, and is individually as follows:

David Carnegie, M.I.C.E., Ordnance Advisor.

Col. Alexander Bertram, Chairman of Committee.

Brig. Gen. T. Benson, Master General of Ordnance.

Lieut.Col. Thomas Cantley.

Lieut.-Col. C. G. Harston, Chief Inspector of Arms and Ammunition.

George W. Watts.

Lieut.-Col. F. D. Lafferty, R.C.A., Supt. Dominion Arsenal.

E. Carnegie.

The Shell Committee Headquarters is Drummond Building, Montreal.

NEW TYPE BRITISH SUBMARINE.

ACCORDING to recent Admiralty notices the submarine W8 will shortly be commissioned, with Lieut. B. A. Beal in command. The submarines designated with the letter W were built by Armstrong-Whitworth & Co. at Elswick, and are of the Laubeuf type of design originated by the well-known French engineer of that name. They differ from the ordinary British submarines in that they have a greater reserve buoyancy, and are more of submersibles than submarines. It was understood that there were only four of these boats to be constructed, and the names given to them were W1 to W4. The meaning of W8, therefore, is not quite clear. These vessels were generally believed to be comparatively small craft of about 500 tons, although their speed is probably quite high.

The difference between this type of craft and the ordinary Vickers design (such as is followed in practically all other British submarines) lies in the variation mentioned above in the reserve buoyancy—that is to say, the difference between the submerged and the surface displacement. In the ordinary British submarine of the largest type, having a submerged displacement of 810 tons, the surface displacement is about 720 tons, leaving a reserve buoyancy of 90 tons, or about 11 per cent. In the Laubeuf type of submarine, whilst the submerged tonnage is 550, the surface displacement is only 400 tons, giving a reserve buoyancy of 27 per cent.

It is generally considered in France that this large reserve buoyancy is a necessity for good sea-going qualities and, as in spite of the relatively small size, many or more torpedo tubes can be carried in these boats and their speed is equal to the larger craft, they may be considered quite as valuable as any of the other vessels.

Canadian Pig Iron Ore.—Most of the ore used for the manufacture of pig iron in Canada during 1914 was imported from Newfoundland, only 182,964 tons being the product of Canadian mines.

Shrapnel Shell Grinding Methods Briefly Outlined

By C. O. Smith*

It will no doubt be of interest to our readers to learn that, while finishing shrapnel shells by turning is being practised by a great many of the firms having contracts to fill, grinding equipment is also being utilized to advantage in producing shells of accurate finished size and form. The accompanying article features some interesting details of the grinding process.

WHILE the manufacture of shrapnel shells has been carried on in all parts of the world with a medium degree of efficiency by relatively few concerns, the present demand is so great and urgent that large numbers of mechanics are undertaking to manufacture them. This naturally brings out many ideas as to methods and also leads in many cases to much misunderstanding and expensive surprises. Some are finishing to size and form entirely by turning. Others, again, are sizing and forming a part of the exterior by grinding, while a number more are sizing and forming the entire exterior by the latter means.

The drawings furnished to the manufacturers and tool builders have shown very large limits for size and form, and have led all concerned into much misunderstanding, for while all have naturally based their estimates—prices and guarantees, on the figures given on these drawings, it has developed, as the production proceeded, that not only must the sizes be almost exact, but the form also. This has not only made it impossible to produce by any of the various methods as many per hour as was anticipated by their advocates, but has led many to adopt grinding as a means of securing the necessary accuracy with the view to obtaining the largest production with the smallest cost of labor.

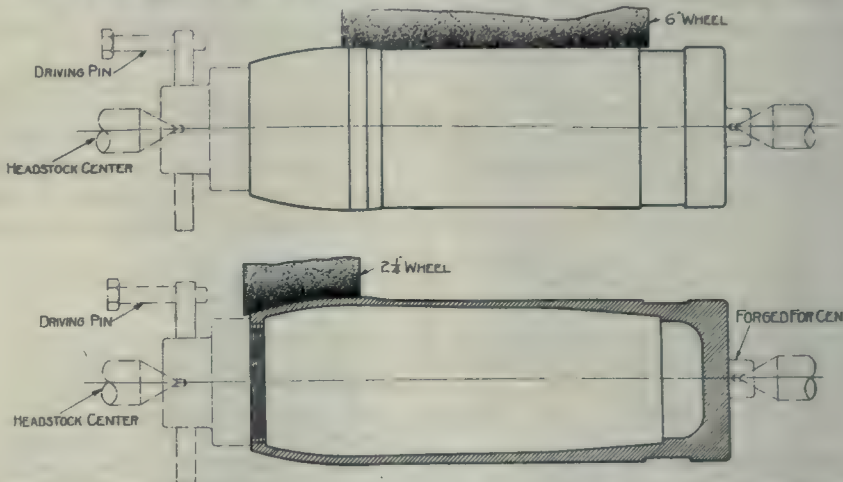


FIG. 2. OPERATIONS 1 AND 2—GRINDING 18-POUNDER SHRAPNEL SHELL ON NOSE AND BODY ONLY.

FIG. 1. SHRAPNEL SHELL BLANKS FINISHED BY GRINDING.

All in any way familiar with the production of round work would naturally assume that these shells would be roughly turned to within .030 in. of the final size whether they were to be finished by nice turning or by grinding, and the earlier estimates of lathe and grinding machine makers were based upon this common experience as well as upon the large limits shown on all drawings. As the work proceeds, however, it develops that the shells come to the grinding machines from the lathe and forming die with from .060 in. to .150 in. over size, and very eccentric, and it is remarkable with this condition that so large a production of accurate sized and formed shells can be secured by the modern method of grinding.

The illustrations show the methods followed when grinding shrapnel, and those who have adopted grinding after this fashion believe that the necessary accuracy is obtained in much less time than is possible by finish turning. Again, as experience sheds more light on the problem, the production will no doubt largely exceed the present figures by all methods.

As to machines for grinding shrapnel shells, the Norton Grinding Co. is prepared to speak with considerable authority, as it has made a thorough study of the subject and is carrying on still further investigations. The blanks shown in Fig. 1 were made for the purpose of demonstrating what could be done on their 6-in. and 10-in. machines.

Fig. 2 illustrates the British 18-pounder shell ground on the nose and body only. The diameter at the closed or headstock end of the shell is finished in the lathe.

*Sales Manager, Norton Grinding Co., Worcester, Mass

Fig. 3 shows the same shell ground on all diameters. Some manufacturers however, are producing these shells by the two-operation process, while one large American concern is finishing them by the three-operation process. The French shell with the three-operation process of grinding is dealt with practically as is the British shell, except in the matter of a few minor details.

Two qualities of finish are usually required for shells, a rough exterior body finish being demanded to take the paint application before shipment.

The 10 x 24-in. special purpose machine, Figs. 4 and 5, was primarily designed for the Ford Motor Co. These machines are equipped with wheels 20 in. in diameter up to 7½-in. face, and are of the type sold to the E. W. Bliss Co. for grinding the body of shrapnel shells. It is not provided with power table traverse, but has a table traverse screw at the right-hand end of the base for truing the grinding wheel. The removal of a horseshoe washer from between the hub of the hand-wheel and the screw bearing permits the movement of the table a maximum distance of 3 in. by the rack and pinion at the left front of the base. The end view, Fig. 5, shows the hand-wheel for screw traverse of the table and the lever action footstock.

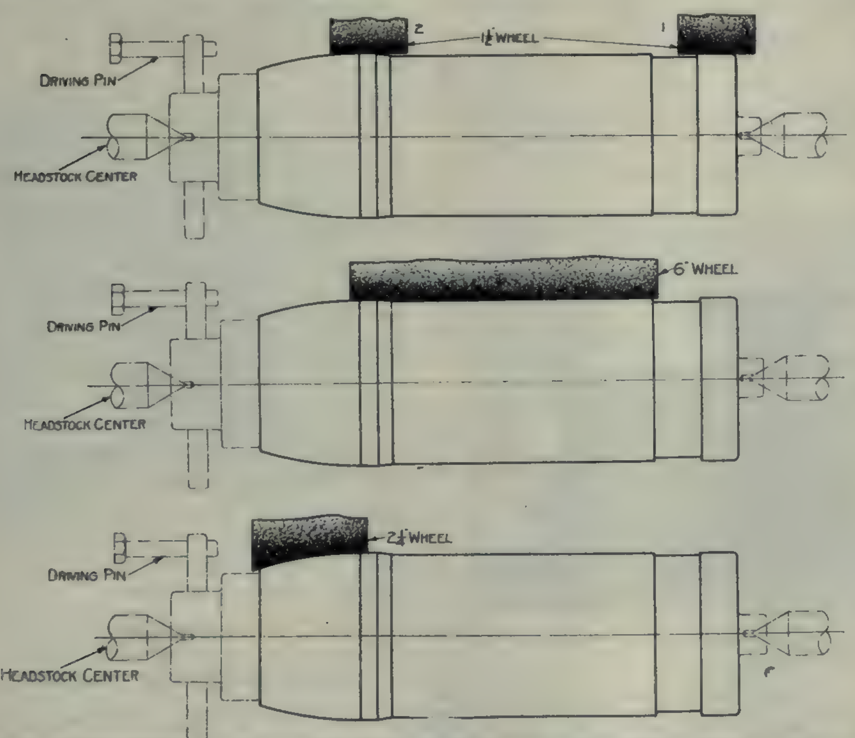


FIG. 3. OPERATIONS 1 TO 4—GRINDING 18-POUNDER SHRAPNEL SHELL ON ALL DIAMETERS.

TRADE RETURNS FOR FEBRUARY.

THE trade statement for February now issued by the Minister of Customs shows a grand total of Canadian trade amounting to $68,853,815, as against $61,009,141 for the corresponding month of last year.

The total trade for the fiscal year to the end of February is less than that of the corresponding period in the last fiscal year, the figures being for this year $967,632,242 and $1,019,675,054 for last year.

The imports for the eleven months, including coin and bullion, amounted to $546,506,184, as against $579,043,950 for the eleven months of 1914.

The February imports amounted to $36,201,826, compared with $38,946,771 in February, 1914.

Exports decreased during the eleven months from $404,888,632 in 1914 to $364,300,581 in 1915, exclusive of foreign goods re-exported. The February exports show a gratifying increase, the figures for the month being: domestic, $28,881,376, and foreign $3,770,613, as against $20,554,087 domestic and $1,508,283 foreign in 1914. The increases in re-exports were largely made up of coin and bullion.

Exports of domestic fisheries, forest products, animals and their products, agricultural products, manufactures, all increased in February as compared with figures for the corresponding period of the previous year, exports of domestic manufactures, nearly doubling. The figures for the latter are $8,982,639 for last February and $4,674,709 for February, 1914.

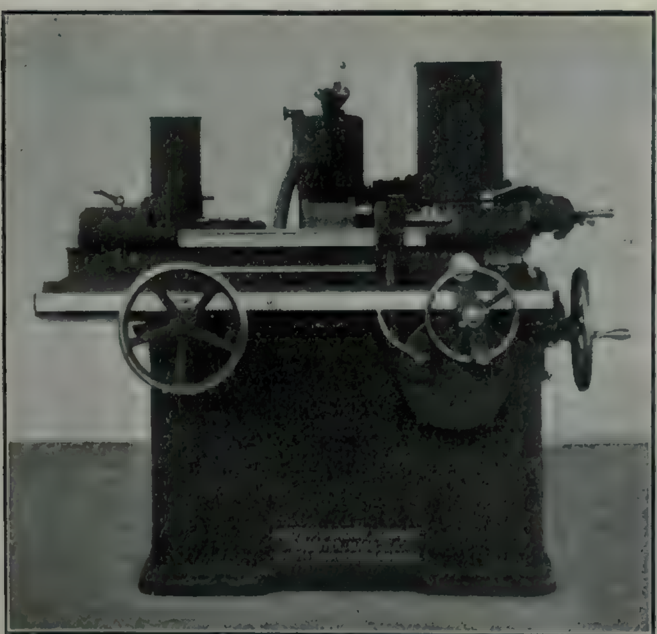


FIG. 4. FRONT VIEW, NORTON 10 IN. X 24 IN. SPECIAL PURPOSE MACHINE.

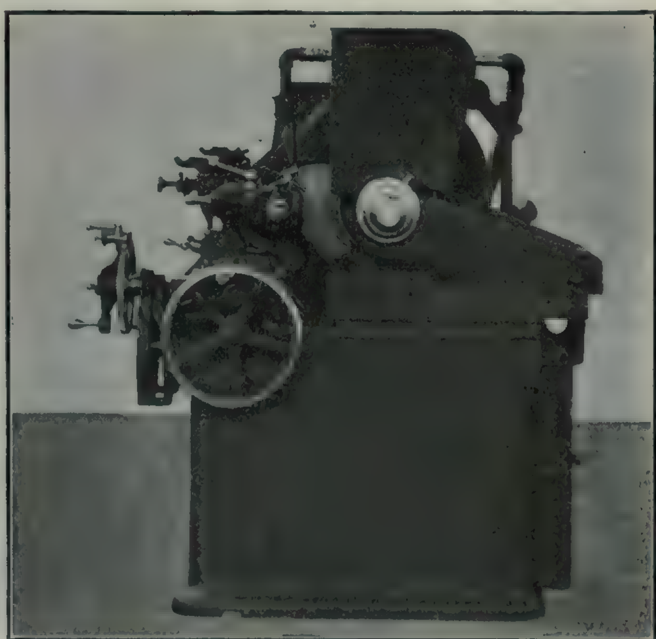


FIG. 5. END VIEW, NORTON 10 IN. X 24 IN. SPECIAL PURPOSE MACHINE.

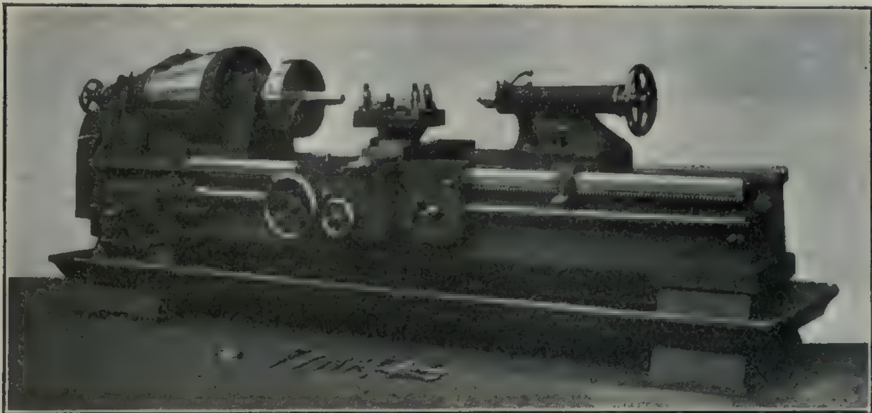
PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SHELL PRODUCTION ON STANDARD MACHINES.

ONE problem confronting Canadian manufacturers who undertook to engage in the machining of 18 pr. shrapnel shells was that of providing suitable equipment. Some decided to install automatic and semi-automatic machines, while others decided to utilize standard lathes with special fixtures to suit the operation required. Our attention has been called to a lathe recently supplied by the John Bertram & Sons Co., of Dundas, Ont., to the Toronto Laundry Machinery Co., which shows very clearly what can be accomplished along these latter lines.

The machine shown is the firm's standard 26 in. double back geared quick change gear engine lathe, equipped with pan, expanding arbor, scroll chuck and four tool fixture, and the operations to be performed consist of turning the shell body to within 2 in. of open end, finishing diameter for distance of 2 in., finishing base and rounding corner.



JOHN BERTRAM & SONS CO. STANDARD LATHE EQUIPPED WITH SHRAPNEL SHELL CASE MACHINING ATTACHMENT.

The forged shell is cut to rough length open end and base before bringing it to this machine, a round dog held by three set screws being attached to open end. The shell is slipped over the expanding arbor, the three jaws of which centre the shell nose from the inside, the arbor being operated by handwheel shown at back end of lathe spindle. The three-jaw scroll chuck jaws engage the inside of open end of shell and the pressure of cut is taken by pin in side of dog, having a bearing against side of chuck jaw.

NEAR VIEW OF BERTRAM SHRAPNEL SHELL CASE MACHINING ATTACHMENT FOR STANDARD LATHE.

With shell in position, the machine is started and tool No. 1 used to rough turn the body to within two inches of chuck face. Tool No. 2 is then moved to position and finished diameter is turned for distance of about 1¾ in. Tool No. 3 next faces end or bottom of shell to a finish, and tool No. 4 rounds the corner completing the series of operations.

The John Bertram & Sons Co. have planned the whole series of machine operations on shrapnel shells with the most careful attention to detail, so much so that the output per each operation, compares favorably with that of machines installed for the specific purpose. One feature that appeals strongly to the average manufacturer is the fact that he requires no special operators and has an outfit of machinery suitable for ordinary machine shop requirements.

SHELL MARKING MACHINE.

A NEW machine specially designed for marking shrapnel shells has been put on the market by the Holden-Morgan Co., Toronto, and is being used for that purpose by several shell manufacturing firms in Canada. The machine will take any size of shell up to and including an 18-pounder, any variation in the shell diameter not necessitating change or adjustment. The machine can be installed on a bench or column bracket conveniently near a shafting line. It does not need a countershaft, as it has only one speed and is continuous running when in operation. It weighs 170 lbs., and occupies a space 19 in. x 12 in. x 19 in. high.

The accompanying illustration shows clearly the general design. The main frame is an iron casting, the direct driven pulley at the back in turn driving the gear through a pinion. Inside the box shaped casting or carrier under the hand screw is the marking die which is fastened to the crank pin by a set screw and is given an oscillating motion by means of the crank and rod connection to the gear wheel. The carrier is hinged to the frame and is kept in place against the hand screw by a small spring not seen in the illustration. The crank has a travel of about 4 ins., which is reduced to approximately 1½ in. on the face of the die. The marking die is about 2¾ in. diameter and is made of tool steel. The first four lines of markings are engraved on, after which the die is hardened. The fifth line which gives the

serial number is removable and consists of a steel ring with slots milled out at the proper distance to take the steel numbers and letters. These can be readily changed to make any series required.

SHRAPNEL SHELL CASE MARKING MACHINE.

The following shows the markings on the die, which of course are also on the shell.

Q. F. 18 Pr.
III
F. S.
(MAKER'S INITIALS)
DATE, NO. OF MONTH, YEAR

When in operation the shell is placed under the die and against the stop as shown. The shell rests on two hardened steel rollers and pressure is applied by means of the hand screw which forces the raised markings on the die into the shell. During this process the shell and die rotate backwards and forwards, or oscillate a sufficient distance to permit all the markings to be effective. The movement of the shell is caused by the die pressing on it. A shell can be marked in less than eight seconds, and the impression is given the proper depth without distorting the shell body. The machine is generally simple in construction and does not require a skilled operator.

THREE NEW MACHINES FOR PROJECTILE WORK.

IN addition to its already extensive line of machinery for the manufacture of guns, projectiles and small arms, the Niles-Bement-Pond Co., New York, has recently brought out a number of new machines which are especially designed for maximum output on this class of work. Three of these machines are illustrated and described herewith, while several more are at present under construction in its various shops.

Hydraulic Projectile Press.

Fig. 1 shows a new design 225-ton hydraulic press, especially adapted for projectile work. It can also be furnished in sizes varying from 50 to 1,000 tons. The press is of the four post, inverted cylinder type, with the cylinder in the cap or upper platen and the piston attached to the middle platen. The lower platen is stationary, the work being done by the downward stroke of the middle or movable platen. The platens are of heavy box section, being 54 in. square. The tension bolts form a guide for the moveable platen. These bolts are of high grade forged steel 5½ in. in diameter, and there is 37 in. x 37 in. clear distance between them.

The main cylinder is supported by the upper platen and is a separate casting. Its plunger is 21⅝ in. in diameter and is hemp packed. At 1,500 lbs. water pressure per square inch, the plunger exerts a downward pressure of 275 tons. The stroke of the main plunger is 36 in. The drawback cylinder is set in the main plunger, its packing being at the top and accessible. This plunger bears upon a yoke, which is tied to the movable platen by bolts. The drawback plunger exerts a lifting pressure of 50 tons, and is directly above and in line with the main plunger centre. The maximum distance from the top surface of the lower to the under surface of the working platen is 76 in. The cylinders are steel. The plunger in the main cylinder is also of steel. The glands are of outside construction for hemp and are easily accessible. The main cylinder is bronze bushed where it is subjected to contact with the steel plunger.

FIG. 1. HYDRAULIC PROJECTILE PRESS.

The press is equipped with an operating valve of the poppet type. It is of hydraulic bronze, with renewable seats, and is operated by hand lever placed in a convenient position for the purpose.

Heavy Duty Projectile Turning Lathes.

Fig. 2 shows a new type of lathe for high production turning on projectiles up to 8 or 10 inches. It is designed for rough and finish turning and is built in two sizes, 20 in. and 24 in. This lathe is of the most solid and substantial construction, with large wearing surfaces, and at the same time is easily and quickly handled in all movable parts. All material entering into the lathe is the best obtainable for the purpose, main and high speed bearings are bushed with high grade bronze, driving and feed gears and feed racks are of forged or cast steel accurately cut, and all shafts, feed screws and bolts are of steel. The bed is wide and deep, with box girder cross ties at frequent intervals, and is provided with flat tracks. The bed is mounted on legs, allowing chips to be readily cleared out, and also giving spindle centre height of 42 in. above floor, which brings the work at a very convenient height for the operator. A rack is cast in the bed near the centre between the tracks, to receive the tail brace pawl.

The headstock is of heavy design, having an especially long bearing on the bed. The face plate is driven by a direct connected 15-h.p. motor of 2 to 1 speed variation. There are four mechanical changes of speed by two levers conveniently located on front of headstock. The speed levers are interlocked so that two speeds cannot be engaged at the same time. The gearing in conjunction with the speed changes by the controller give 60 face plate speeds, varying from 12 to 350 r.p.m. The motor is started, stopped and reversed by a drum type switch, mounted at the head end of bed. Dynamic brake is provided for instantly stopping work. The pinion driving the main face plate gear is so mounted in the headstock as to eliminate any tendency of the resistance of the cut or of the power applied to this pinion to lift the main spindle in its bearings; also the main spindle caps are relieved of the upward thrust due to the cut.

The face plate is removable permitting the rapid interchange of face plate and chuck. All bearings in the headstock are bronze lined, the shafts and spindles being accurately ground to size. All the bearings and gears in headstock are en-

tirely enclosed and oiled continuously from a tank in the head, which is kept filled by a geared pump drawing oil from a tank under the head, into which all surplus oil drains and is filtered before use again. Oil supply pipe visible feed and tank is provided with a gauge showing oil level. The main spindle thrust bearing is self-oiling and of ample diameter.

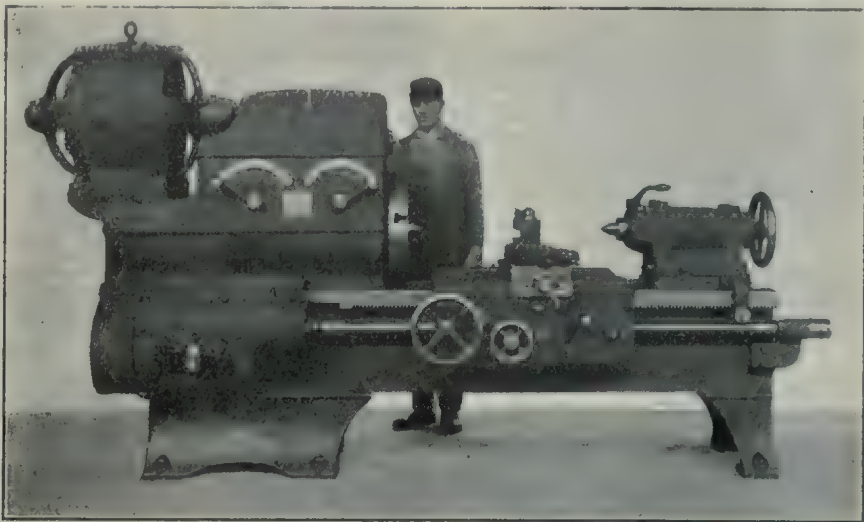


FIG. 2. HEAVY DUTY PROJECTILE TURNING LATHE.

The carriage is fitted with flat tracks bearing the entire width, making a very short span for the bridge of carriage. The carriage is gibbed to the bed underneath the tracks both front and back. Wipers are provided at each end to keep the bearing surfaces clean. The tool rest is of the compound swiveling type, travels in a wide bridge and is of such length that the bearing surface is not uncovered when turning largest diameters. The tool has both hand and power longitudinal and cross feed in either direction. The upper slide has a swiveling tool holder open on one side and of ample strength for holding tools 1¾ in. x ⅞ in. The lower tool slide, swivel and upper slide are steel castings.

The apron is of substantial, ribbed box construction, supporting the feed gear shafts at each end. All rotating bearings are bronze lined, with ample provision for lubricating all from one point. The friction for engaging the power feed is of large diameter, giving operator complete control under all conditions. A wide range of feeds is provided, and the changes are by a quick-change gear mechanism operated by one handle. A screw cutting mechanism can be furnished when desired.

The tailstock is of very large box section, which is considerably increased toward the end carrying the centre. The tailstock can be securely fastened in any position on the bed, by means of four large bolts, running to the top and heavy clamps. In addition to this, a tail brace engaging a rack in the bed is provided which prevents absolutely the tailstock from slipping under heavy end thrusts. The spindle is of forged steel of large diameter, and a graduated set over for small tapers is provided.

Principal Dimensions.	20 in.	24 in.
Length of bed	8 ft.	8 ft.
Takes between centres	2 ft.	2 ft.
Swing over bed	21 in.	25 in.
Swing over carriage..	11 in.	13 in.
Length of headstock on bed	3 ft. 7 in.	3 ft. 7 in.
H.P. of motor........	15	15
Spindle—		
No. of speeds....	60	60
Max. r.p.m.	350	350
Min. r.p.m.	12	12

Heavy Projectile Boring Lathe.

Fig. 3 shows a 36 in. massive powerful lathe for rough and finish boring of projectiles from 6 in. to 14 in. diameter. Although it is of the heaviest and most substantial design throughout this lathe can be handled with ease and facility. All of the driving and feed gears and feed rack are forged or of cast steel; all shafts, feed screws and bolts are of steel, while all main and high speed bearings are bushed with high grade bronze. The bed has flat tracks and is of large cross section, with box girder cross ties at frequent intervals. A rack is cast in the centre between the tracks for the tail brace pawl.

FIG. 3. HEAVY PROJECTILE BORING LATHE—FRONT VIEW.

The headstock is of especially massive box construction. It is extremely long, being 7 ft. 5 in. on the bed, furnishing a most rigid support for the spindle, gearing and motor. A further idea of the enormous proportions of the head can be gained from the size of the front spindle bearing which is 8 in. in diameter and 23 in. long. All of the bearings and gears are entirely enclosed, and oiled

FIG. 3. HEAVY PROJECTILE BORING LATHE—REAR VIEW.

continuously from a tank in the head which is kept filled by a pump drawing oil from a tank in the bed. The main spindle is driven by a 35-h.p. direct connected, variable speed motor mounted on the headstock, through gearing which gives three mechanical changes of speed controlled by convenient handwheels. The gearing in conjunction with the speed variation of the motor by the controller gives 60 face plate speeds varying from 2½ to 77 r.p.m. By means of a handle adjustably mounted on the bed, the face plate may be started, stopped, reversed, or any of the different motor speeds obtained, without requiring the operator to leave his position at the boring tool.

The low speeds of the face plate are obtained by a pinion driving the face plate gear and so mounted in the headstock as to eliminate any tendency to lift the main spindle in its bearings and also relieving the main spindle caps of the upward thrust due to the cut. The higher speeds are obtained by driving through the face plate spindle, thus obviating the necessity of running the face plate pinion at an excessively high speed. The main spindle thrust bearing is of the roller type, self-oiling and of large diameter.

The boring tailstock is fitted with a square boring ram of forged steel, and of large cross section. The feed for the ram is from a shaft running from the head along the back side of the bed. The feed is through rack, gear, pinion and worm gear to give smooth motion. The feed is started and stopped and reversed by large hand spiders. Eight feeds are provided, varying from .005 in. to .030 in. per revolution of the face plate. Four of these feeds are operated by a positive clutch mechanism without change of gears, the changes being made by two levers on the front side of the tailstock, and traveling with it. The remaining four feeds are obtained by one change of gears at the head end. The boring bar has a continuous feed of not less than 48 in. without resetting of the tailstock.

The tailstock is long and of large cross section, affording rigid support for the boring ram. The tailstock can be securely fastened in any position on the bed by large bolts and heavy clamps. In addition, the tailstock is fitted with a tail brace engaging the rack in the bed which prevents slipping under heavy end thrusts. A support which slides with it on the bed, is provided for the boring ram. This supports the ram near the end carrying the tools and tends to prevent vibration. The steady rest is designed to take from 6 in. to 20 in. in diameter. It is of stiff box section, with four jaws of large cross section.

GUN RIFLING MACHINES.

THIS machine is in two parts, consisting of a bed with two reversible steady rests to support the gun, and a runway mounted on legs which carries the traveling carriages and bearings for supporting the rifling bar. The bar is held longitudinally in the carriage bearing seen in the photograph near the left hand end of the runway but is free to turn therein, and is provided with a spiral groove of the same pitch as the rifling in the gun. The index head at the extreme right has a pin which engages in the master groove of the bar, thus imparting its rotary motion in combination with the longitudinal movement derived from the traveling carriage. A twisting tension is kept on the bar by the counterweight mechanism on the carriage which obviates the danger of lost motion due to the wear of the pin which engages in the master groove. The intermediate bearing provides an additional support for the bar, and is so geared as to travel at exactly one half the speed of the carriage, thus remaining always equidistant between the carriage and the index head and reaching the end of the runway simultaneously with the carriage. The index head provided a means of setting the bar for a given number of grooves. The carriage and half speed bearing drive their motor from a quick pitch screw 4¾ in. in diameter with a shifting belt drive as in the photograph or by a direct connected reversing motor such as is used on planer drives.

The machine will rifle guns up to 8 ins. bore, any length desired, and is provided with a powerful oil pump driven by a 3 h. p. motor, and with a telescoping oil pipe. For rifling guns 8 ins. bore by 30 ft. long, the machine weighs about 50,000 lbs., and requires a 10 h. p. drive. The driving gears are completely covered, and cutting and return speeds of any reasonable amount can be arranged.

GUN RIFLING MACHINE FOR BETHLEHEM STEEL CO.

Detrick and Harvey, Baltimore, Md. are the designers and manufacturers of this product.

GUN BORING LATHES.

THIS lathe built by the Detrick & Harvey Co., Baltimore, Md. is equipped with an all-geared motor driven headstock, the motor being attached directly to same, and having a solid forged steel spindle 5¾ ins. in diameter running in bronze bushed bearings each 12 ins. long. The spindle thrust is taken by a roller bearing 8 ins. in diameter, thus eliminating excessive friction at this point. A 3 to 1 variable speed motor is used, which with four gear changes gives speeds ranging from 2 to 111 r.p.m. Ten reversible all gear feeds from .002 to .020 are obtained through change gears, and by shifting a clutch these may be increased to from .030 to .333, making twenty changes in all. The spindle is provided with a threaded nose to receive chucks. All driving gears and pinions are of steel or bronze and all driving shafts run in bronze bushed bearings. The boring carriage has a bearing which will accommodate bars up to 4¾ ins. in diameter.

This lathe is not designed for turning, but an extra carriage is provided having a plain tool rest with hand cross

SECTION OF BED FOR GUN RIFLING MACHINE.

feed for cutting off or trimming up the work. Both carriages are fitted to the ways by square locks and have steel taper gibs for taking up wear, power

GUN BORING LATHE.

longitudinal feed which may be disengaged at will, and the usual rack and pinion hand traverse. To avoid unequal pull on the carriage, the lead screw is placed between the ways directly under the bar. It is 3 ins. in diameter and is held in tension between capped bearings in the bed with ball thrust bearings. Two steady rests are provided, one taking from 3 ins. to 10 ins. in diameter, and the other from 6 ins. to 18 ins. Bearings to support the boring bar are also furnished. The machine swings 27 ins. over the ways and is designed for boring guns up to 6 ins. calibre of any length.

An oil pump of unusually large capacity is used and is driven by an independent motor. The large leg under the bed at the headstock serves as an oil reservoir and is fitted with a strainer and removable chip pan. The bottom of the bed is given an inclination towards this reservoir in order to retain the waste oil. Oil is delivered from the pumps by means of a telescoping tube to the cutter. All gears are covered. A 10 h. p., 3 to 1 variable speed motor is required for the drive and a 3 h .p. motor for the oil pumps. The machine with 30 ft. bed weighs about 24,000 lbs.

LATHE TURRETS FOR SHELL MANUFACTURE.

MODERN methods of manufacturing to obtain the most economical production, demand carefully designed special tools and fixtures, capable of performing duplicate operations accurately and to the best possible advantage. Automatic turrets for carrying these special tools have rapidly come into general use, the large expense necessary to install specially designed turret lathes being oftentimes not warranted by the amount and nature of the work to be performed. The accompanying illustrations show two designs of lathe carriage turrets, known as styles B and G, and manufactured by Fay & Scott, of Dexter, Maine.

These turrets are designed to go on the lathe carriage in place of the regular tool block, and are made for carrying ordinary lathe tools, or tools with round shanks. All styles have a patented revolving and locking mechanism, which, by a single movement of the lever handle, forward and back, releases the turret, turns the next tool into position and locks the turret. This is a quite valuable feature, inasmuch as it requires the use of but one hand of the operator.

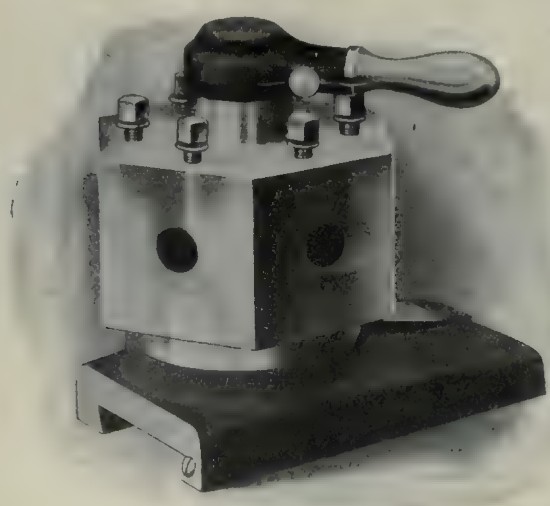
The turret base is fitted with taper gib adjustable for wear, and the locking pin is also fitted with an adjustable taper gib. The locking pin and ring are made of tool steel, hardened and ground to reduce the wear on these parts to a minimum.

The turrets are guaranteed to index accurately, to within a fraction of a thousandth, and each tool has provision for adjustment, by means of a segment, or rocker chip, same as used in the regulation tool post. Two binder screws serve to hold each tool securely. By the use of turret equipment attachment, a valuable addition is made to the regular capacity of an engine lathe, while many of the advantages of a first-class turret lathe, with the exception, perhaps, of a few automatic features, are available.

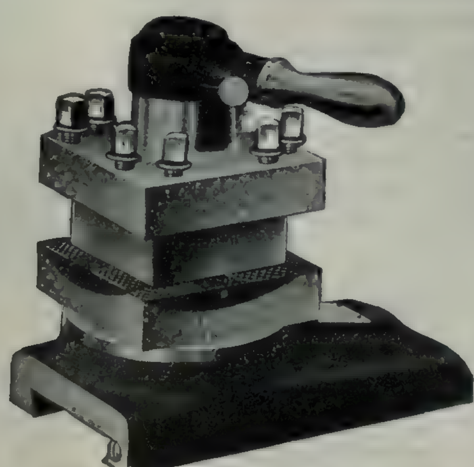
Style B turret has a hexagon head, and the faces can be drilled to jig for bolting on special tools or fixtures.

Style G is in the nature of a four-sided tool post, carries ordinary lathe tools, and is very suitable for general work, such as turning, boring, threading, etc. It can also be used for carrying special forming tools and performing the same functions as the ordinary tool post. Its advantage is in having four tools always in position to be brought quickly into successive operation.

Since the manufacture of shrapnel shells became so prominent a feature of the output of our Canadian engineering shops, we understand many large orders, including repeat orders for these turrets, particularly style G, have been received and filled by Fay & Scott.



STYLE B LATHE CARRIAGE TURRET.

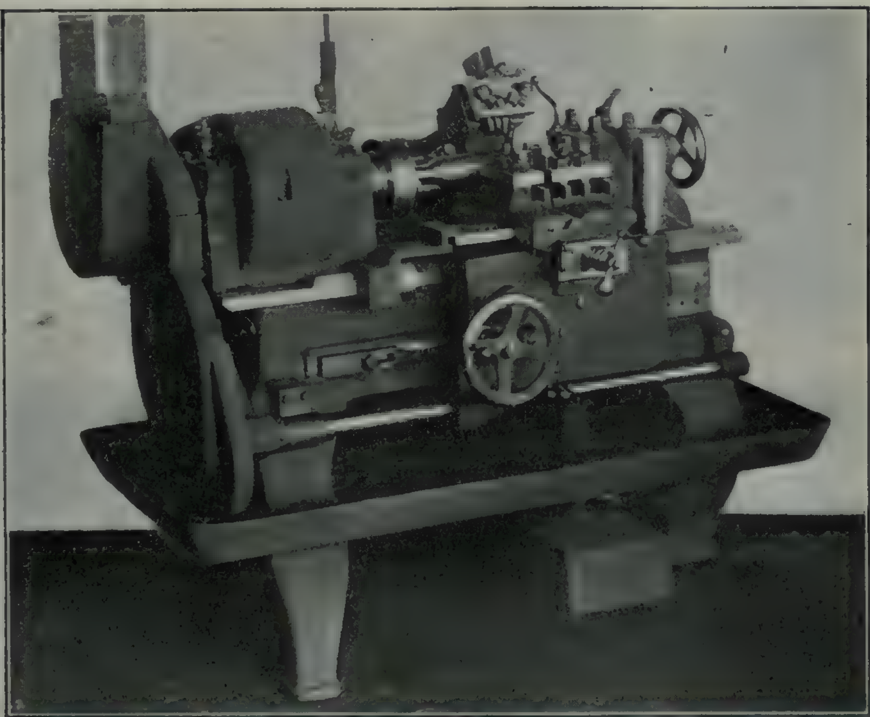


STYLE G LATHE CARRIAGE TURRET.

14-IN. HEAVY AUTOMATIC SHRAPNEL LATHE.

THE illustration and description refer to a recent product of the Reed-Prentice Co., Worcester, Mass., which is known as their heavy automatic shrapnel lathe. It is here shown tooled-up for machining British 18-pounder shrapnel shells, roughing and finishing, in the latter of which it performs the interesting operation of radius turning in forming the shell nose.

Previous to the roughing operation, the shell is centered on its closed end in a sensitive drilling machine specially equipped for the purpose with a centering device. The forging has also been cut to length. In the heavy automatic, the rough piece is held by the internal expanding jaws of a chuck at the open end and by the tail centre. The front tool block supports four cutting tools, which are fed into the work to the required diameter by a cam feeding-in element that controls the automatic cross slide with the travel of the carriage. An actual travel of about 2 in. is required to rough turn the full length.



14-INCH HEAVY AUTOMATIC SHRAPNEL LATHE.

While the front tools are performing the diametral work, the back arm is brought forward with its three or four tools—according to the design of the shell as adopted by the individual Government—and forms the groove for the copper rifling band, squares down the closed end, rounds the corner and in some cases forms the small groove to receive the brass powder case, which is spun upon it. The back arm is operated by the longitudinal travel of the carriage which carries a cam that determines the feed of the back arm tools. The time required for these operations is 4 min.

The shell next goes to a turret lathe to have the diaphragm seat and powder chamber bored out, and the open end rough turned and rough squared. Another machine undercuts the groove for the copper band, and waves or knurls its bottom, to prevent the band from slipping. The shell is then heat-treated and the open end again heated in a lead bath and closed in, to form a portion of the nose.

The next process is the boring out and reaming, squaring down the open end and threading it to receive the fuse plug, which operations are performed in a turret lathe. The shell is copper banded and is then ready to go to the heavy automatic for the finishing operation. A threaded plug with driver is screwed into the open end, and the shell is placed between centres, to be given a finishing cut all over, including the radius turning of the nose. The front tool block is constructed specially for this operation. A wide bottom block, operated by the cam feeding-in attachment, carries two tool blocks, one of which is securely fastened to the bottom block and has two or three tools, as required, for the straight turning of the shell body.

The second block is mounted on a dovetail of the bottom block and is actuated by a cam surface which is held stationary in relation to the bed, so that the longitudinal movement of the carriage will force the auxiliary holder into the work in whatever form the cam surface may prescribe. The form in question is that of the radius of the nose. The back tool block carries a forming tool, the shape of which is governed by that of the copper band. This is not shown in the cut.

The time required for the finishing processes is also 4 min., so that the two machines together perform their work at the rate of 15 shrapnel an hour or 135 in a 10-hr. day, allowing the usual reduction of 10 per cent. for lost time.

SHELL MANUFACTURE AT HAMILTON, ONT.

ANNOUNCEMENT was made on March 13 that Hamilton manufacturing concerns had secured orders for shells and parts of shells that totalled over $2,000,000 in value. The following firms got orders to the value of shells or parts of shells opposite their names:

Brown, Boggs Co., $15,000; Canadian Westinghouse, $75,000; Dominion Steel Foundries, $50,000; National Machine Co., $15,000; Petrie Mfg. Co., $15,000; Sawyer-Massey Co., $20,000; Smart-Turner Co., $10,000; Steel Company of Canada, $65,000; Chadwick Bros., $400,000; Canada Steel Goods Co., $200,000.

Cartridge Clips.

Chadwick Bros., $100,000; National Steel Car Co., $100,000; Steel Company of Canada, $520,000; Canadian Westinghouse Co., $25,000; Dominion Steel Foundries, $60,000; Hamilton Brass Co., $125,000; Tallman Brass Co., $100,000; Schultz-Meng Co., $200,000; National Machine Co., $200,000.

Plugs and Sockets.

Canadian Westinghouse Co., $150,000; Chadwick Bros., $40,000; Hamilton Brass Co., $50,000; Tallman Brass Co., $75,000.

Tubes.

Hamilton Brass Co.. $50,000.

RECENT BRITISH NAVY ADDITONS.

THE Navy List for January reveals the fact that several vessels have been put into commission since the last list was issued in December. Two light cruisers have been added, these being the Cordelia and the Caroline, the latter being the boat which was built in record time.

These boats have a displacement of about 3,800 tons, and the designed speed is 30 knots, although this can probably be exceeded when required. The machinery installation gives a total indicated horse-power of 40,000, and the boilers are fired by oil fuel only, about 750 tons being carried. Turbine machinery is, of course, installed, and the armament consists of two 6-in. and six 4-in. guns, both being of 50 calibres. There are four 21-in. torpedo tubes above water, one pair on each side.

Six more boats of this class have yet to be put into commission, three of which

are listed as building and three as completing. All these vessels are of the 1913 estimates. but there are still four light cruisers of the 1912 estimates to be finished. One of these was completed and commissioned on the 10th December last, this being Penelope, a sister ship to the Arethusa. The Penelope is of very much the same size as the Caroline class, the displacement being 3,600 tons and the draught about 14 feet. The armament is the same, and the power installation is between 36,000 and 37,000 i.h.p., giving the same speed of about 30 knots. All these boats have a 3-in. armoured belt.

Among the destroyers commissioned since the last month's issue of the Navy List are the Matchless, the Mentor, Milne, Morris, and the Murray. These boats probably have a speed of about 35 knots.

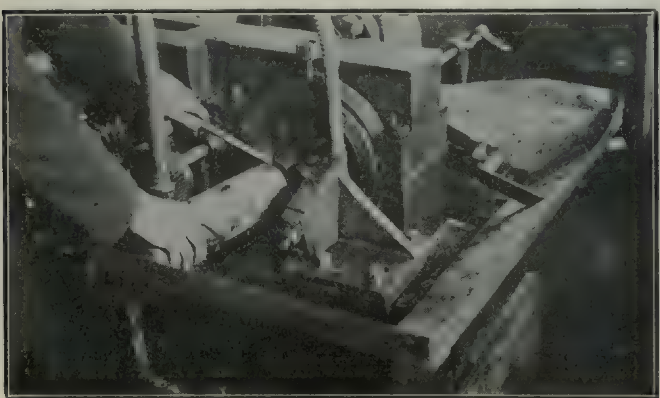
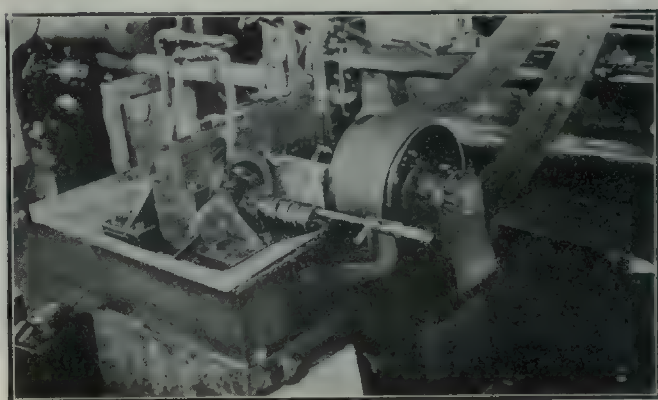
CUTTING-OFF AND FACING MACHINE.

THE accompanying illustrations show the cutting-off and facing machine for shrapnel shell forgings which is manufactured by the Hamilton Gear and Machine Co., Toronto. This machine cuts off the excess length at the mouth, and rough faces the base of the shell at one operation, the two tools working simultaneously on the two ends of the forging, which is held and driven at the middle. With a surface speed of 80 feet per minute, the actual cutting time is 40 seconds. The additional time for returning the tools to the starting position and changing work bring this up to about one minute or a minute and a quarter, according to the activity of the operator. On an all-day run, an additional quarter or half minute should be allowed for tool changing and other delays.

The shell is located from a stop against the inside of the base, thus ensuring standard thickness of the latter. The forging is gripped in an automatic chuck by six spiral cam jaws, which hold more tightly, as greater force is applied by the cut. The curve of the jaws is so chosen that, while the gripping power is very great, there is no tendency to jam, and the chuck opens easily after the heaviest cuts. These jaws are of tool steel and work in tool steel bearings, while an internal ring gear compels the jaws to act concentrically. A tight-fitting cast iron bushing keeps chips and dirt out of the mechanism.

The drive is by an 8-inch belt through a Dodge friction clutch, and all the spur gears, both on the drive and feed, are steel, except the large chuck gear, which is cut from the solid chuck body. The moving gears for changing the feed to quick return are of heat-treated chrome nickel steel. The feed worms are steel and the worm wheels phosphor-bronze. All the bearings are high-grade Babbitt except the slow-running bearing of the revolving head.

The machine automatically stops at the end of the tool travel, and a quick return is provided of four times the cutting speed. A gear pump supplies a three-quarter inch stream of cooling liquid for each tool from a large reservoir in the base. The cooling system is claimed to be so effective that the tools do not suffer from heat at all, but only wear out from actual rubbing of the chips. The tool-holders are of heavy duty design and of such shape that they will take long lengths of high-speed steel bar without forging, thus eliminating waste in short ends. All gears are completely enclosed, the main gear dipping into an oil bath. Gauges are supplied for grinding and setting the tools. The machine can be arranged for motor drive if desired, and can also be supplied in a 5-inch size for cutting up billets for $4\frac{1}{2}$-in. howitzer shells.

CUTTING-OFF AND FACING MACHINE FOR SHRAPNEL SHELL FORGINGS.

TRANSPORTING BRITISH REINFORCEMENTS.

FRESH British troops, sent as reinforcements to the army of the allies, are being more or less continuously landed in France, and this is done in an altogether admirable way. The great transport ships enter various French ports while the North Sea and the channel are protected by torpedo boats, destroyers, and a few swift cruisers. The transport ships follow each other at short intervals. A calm, cheerful mood prevails on board, when the soldiers enjoy the freedom which is always their privilege in leisure hours.

Hardly, however, has the French coast been sighted than everything is arranged with the utmost speed for the landing. As a ship swings into its place the soldiers stand ready to march. The wagons of the division are ready loaded. Ample space has been reserved on the quays for the landing, but no more are landed than the railways can carry at a time.

As soon as a ship is empty she moves on at once to another point in the harbor, and is followed by a new transport. with almost clock-work regularity. The efficiency of the organization is well illustrated by the fact that in one French harbor no less than 28 transports discharged within 24 hours.

Shell Manufacture.—According to a return presented to the House of Commons recently, over 200 factories from Cape Breton to Winnipeg are engaged in the manufacture of shells. The steel being used is all Canadian and is being supplied by the Nova Scotia Steel & Coal Co. of New Glasgow; Dominion Iron & Steel Co., Sydney; Steel Co. of Canada, Hamilton; Algoma Steel Co., of Sault Ste. Marie; the Electric Steel Co. of Welland, and the Canadian Steel Foundries in Montreal. Until the outbreak of this war, with the exception of the Dominion Arsenal in Quebec, not one factory in Canada had ever made a shell. Already the contracts for shells are reckoned to amount to $80.000,000.

Of Canada's 1914 output, Ontario produced the largest quantity of pig iron, namely, 556,112 tons. Nova Scotia made 227,052 tons.

Finishing Shell Parts on Automatic Chucking Machines

By C. T. R.

Of no less importance, either in the matter of accuracy or that of profitable output with respect to the shell body finish are those of the various accessory parts which go to make up the complete shell unit. That quality and quantity production can be profitably realized is made evident by a study of the detail operations featured in this article.

BEFORE detailing the various operations involved in the production of the shrapnel shell parts illustrated in Fig. 1, a more or less brief description of the particular type machines on which the work is performed will be first in order.

The machines are a product of the New Britain Machine Co., New Britain, Conn., and are built in two distinct automatic multiple spindle types, single head

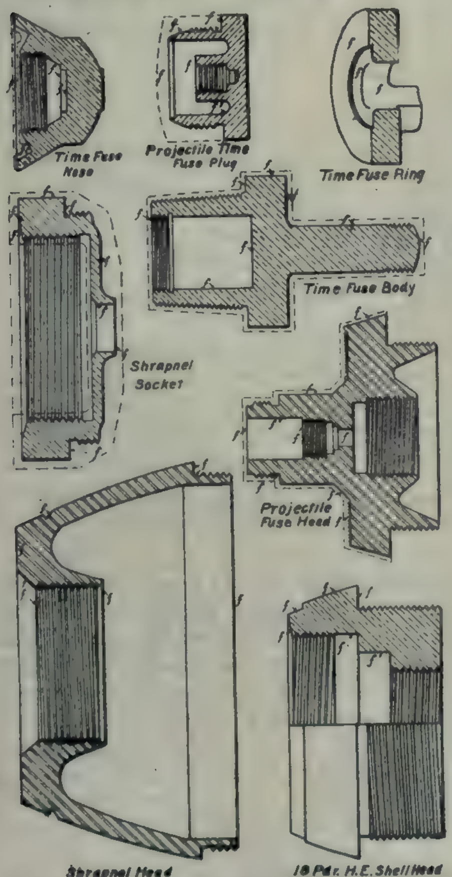


FIG. 1. DETAIL OF SHELL PARTS FOR MACHINING.

and double head. The former are designed for machining pieces which require operations on but one end, or on pieces where one end has already been machined. The double head type handles pieces requiring operations on both ends, accomplishing the result in one half the time which would be required if each end were finished separately in a single head machine.

As their name implies, the machines have several spindles, ranging from four in the small single head machines, to eight in the large double head. The spindles carry and revolve the tools, while several pieces of work are held stationary in the multiple chuck turret, which, when it indexes, brings each piece

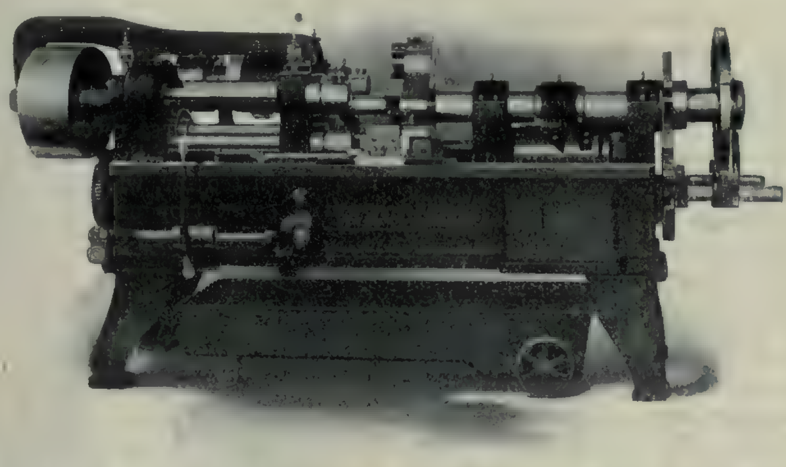


FIG. 2. AUTOMATIC MACHINE, OF SINGLE HEAD TYPE, WITH FOUR WORKING SPINDLES AND FIVE CHUCKING POSITIONS.

of work in line with the next succeeding spindle. All machining operations take place in the intervals marked by the automatic progression of the turret indexing mechanism, the time necessary to complete a piece being measured by the period required for the longest single operation on it.

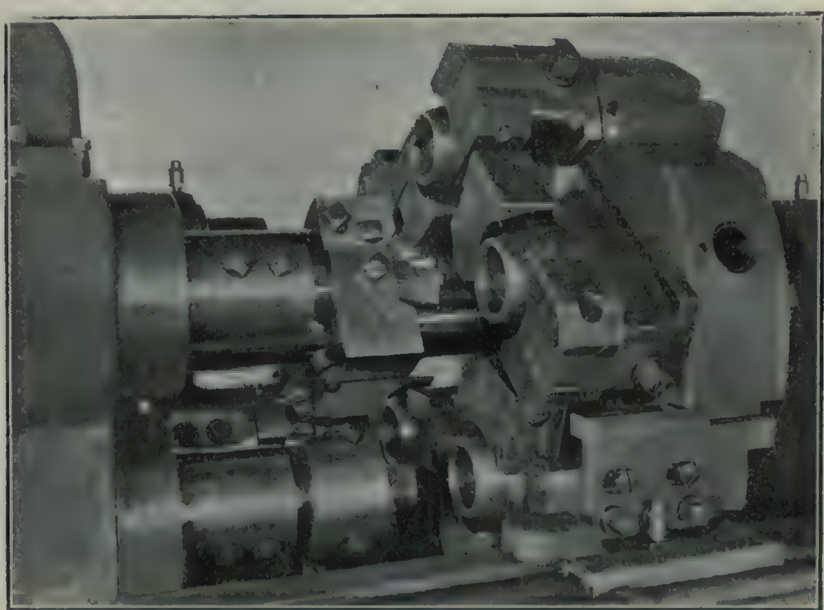


FIG. 3. VIEW OF CHUCK JAWS FOR SHRAPNEL SHELL HEADS.

In the case of the single head machine the turret advances and feeds the pieces of work against the revolving tools, while in the double head the revolving tools advance from both sides and form their operations on each end of the work. In this way a series of operations are carried out on several pieces of work simultaneously, the pieces approaching completion as they progress from one tool to another.

The centres of the work-holding sections of the turret are arranged in a true polygon. The tool spindle centres are directly opposite and aligned with all but one of the turret section centres

on the point of the polygon. As the turret indexes, it brings the chuck section opposite where there is no tool, in the most accessible point to the operator for unloading and loading.

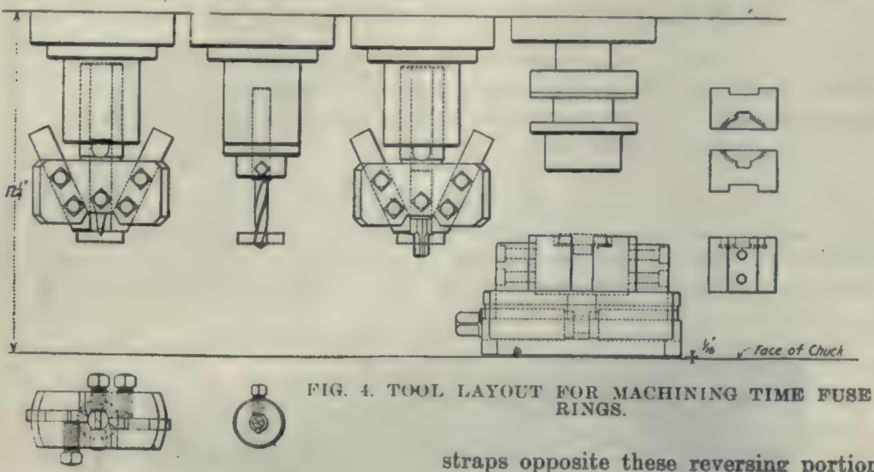


FIG. 4. TOOL LAYOUT FOR MACHINING TIME FUSE RINGS.

Single Head Machine.

In the single head machine, the work-holding multiple chuck turret has its chucking sections in line with and facing the tool carrying spindles. The turret is mounted on one end of a rigid turret barrel, which will both turn and slide in two large bushed bearings. On the opposite end of the barrel is the indexing mechanism which automatically locates the turret in its different indexed positions.

Directly below the turret barrel and between its two supporting bearings is a large drum mounted on a shaft, which is revolved by a worm gear at the extreme left of the machine. Cam straps are bolted to the outside of this drum and act directly against a hardened tool steel roller on the turret yoke, which may be clamped in any position on the barrel. This yoke adapts the machine for handling different lengths of work, and in most cases avoids the necessity of any change in cam position or overhang of tools. The angle of the cam straps depends upon the length of feed required on the piece being machined, and the balance of the path of the cam changes rapidly to quickly throw the turret forward and back to clear the tools at the time of indexing. Guard straps opposite these reversing portions of the cam prevent the turret from being thrown too far, while an adjustable positive screw stop on the side of the turret yoke accurately gauges the forward movement of the turret.

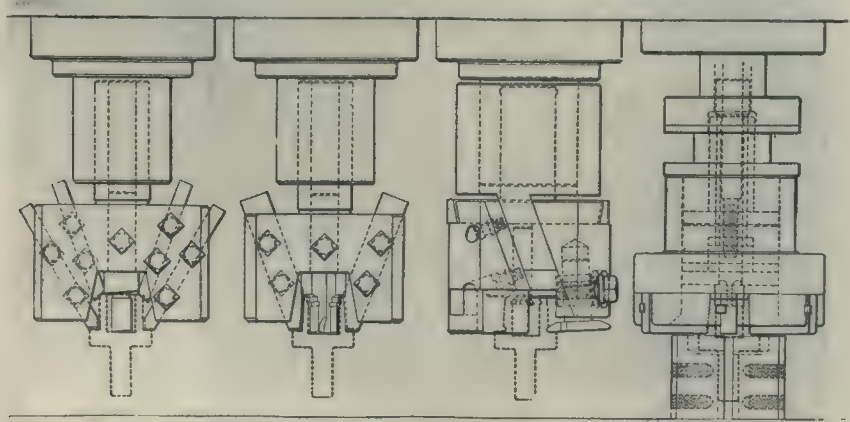


FIG. 5. TOOL LAYOUT FOR MACHINING TIME FUSE BODIES—FIRST OPERATION.

All turrets have one more chucking section than there are tool spindles. This section is used for loading and unloading without loss of time while the machining operations are being carried on simultaneously in all the other turret positions. Each pair of chuck jaws is independent of the others, and is quickly operated by a right and left-hand screw, which has a square end extending for a chuck wrench. The chuck, when equipped with proper shaped jaws, will accurately centre and adequately grip the work. The screws and chuck jaws are made from crucible tool steel hardened.

Double Head Machine.

Corresponding sets of tool-carrying spindles are mounted on the bed of the machine at either end. The multiple chuck turret is midway between the two shafts, having the indexing mechanism at the extreme right. All sets of chuck jaws are in line with the spindles, and are designed to hold the work centrally in order that machining operations may be carried out on both ends of a piece at the same time.

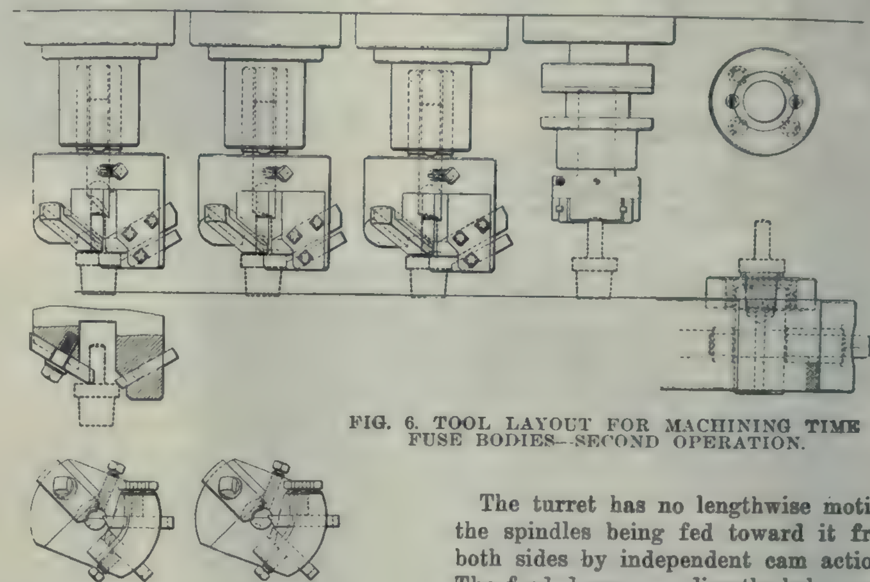


FIG. 6. TOOL LAYOUT FOR MACHINING TIME FUSE BODIES—SECOND OPERATION.

The turret has no lengthwise motion, the spindles being fed toward it from both sides by independent cam actions. The feed drums are directly below each group of spindles, and are mounted on a shaft driven by a worm gear at the extreme left of the machine. Cam straps to control the movement of the spindles in accordance with the requirements of the work, are bolted on the outside of these drums and act directly against hardened tool steel rollers on the spindle yokes.

Each group of spindles, being independent, may be cammed and tooled for like or unlike operations, depending upon the design of the piece being machined. The angle of the cams varies according to the length to be machined. The balance of the path of the cams changes rapidly to quickly withdraw the tools to clear the work each time the turret indexes. Guard cams prevent the spindles from being thrown too far back, and positive screw stops are provided on the yokes to accurately control their forward movement. The opposite spindles being in alignment make it possible to

finish pieces of work on both ends concentrically.

A steady rest of the sliding key design automatically locks the turret to the bed of the machine while the tools are in operation. This feature adds greatly to the life and accuracy of the machine, as the turret barrel and indexing mechanism are relieved of all strain during machining operations. Independent devices are provided for taking up wear in both directions. Steady rests are fitted to both single and double head machines.

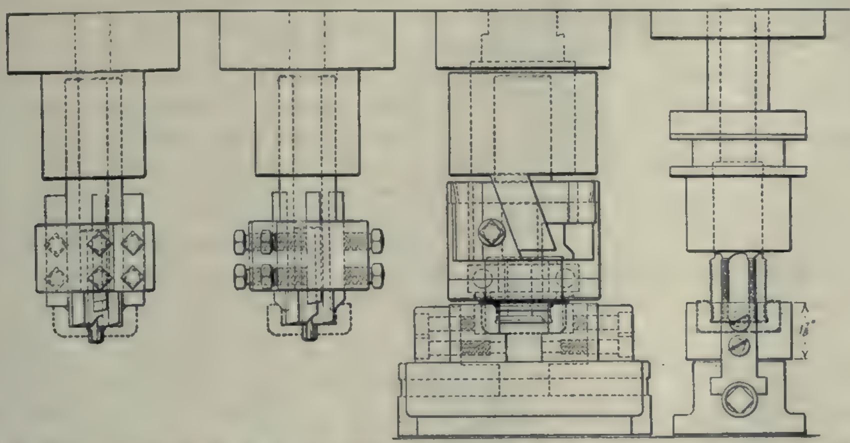


FIG. 7. TOOL LAYOUT FOR MACHINING SHRAPNEL SOCKETS—FIRST OPERATION.

Having described some of the more outstanding features of these multiple spindle automatic chucking machines, a recital of the operations involved will now be given relative to the production of shrapnel shell accessory parts.

Time Fuse Ring.

The time fuse rings Fig. 1, are brass forgings and come to the machine with the holes undrilled. The rough blanks weigh 6 oz., and the finished parts, 4 oz. each. The operations are performed at one setting on a four-spindle machine, tooled as shown on Fig. 4. The parts are gripped in a two-jaw chuck and the plain end faced, drilled and counterbored. To avoid retarding production, a high speed spindle which runs five times the speed of the main spindle is installed on No. 2 spindle, and this opens up the holes so that they can be finished with a counterbore in the No. 3 spindle. The production is 240 per hour and the tool-cutting speed approximately 80 ft. per minute.

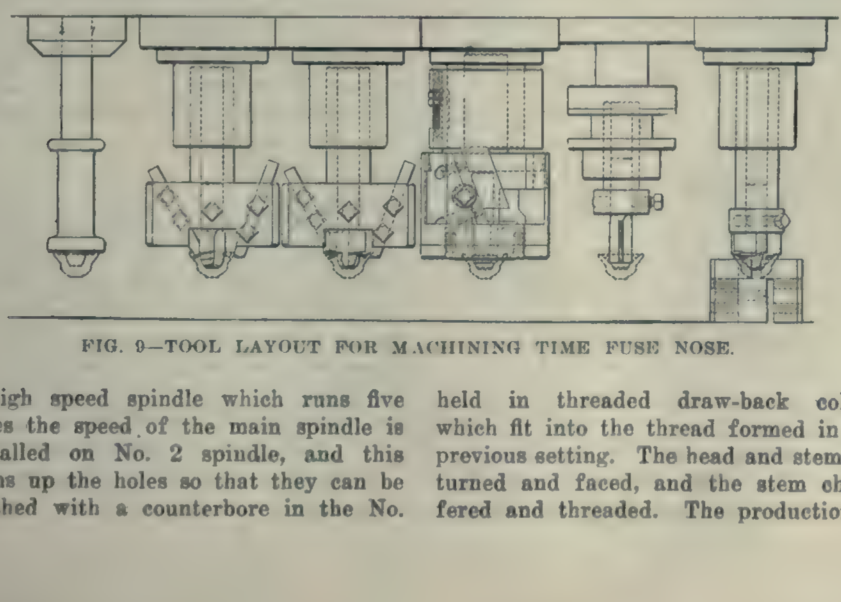


FIG. 9—TOOL LAYOUT FOR MACHINING TIME FUSE NOSE.

Time Fuse Body.

The time fuse bodies come to the machine as brass forgings, Fig. 1 in dotted lines, and weigh 13 oz. each. They are machined in two settings, Figs. 5 and 6 on a four-spindle machine, and take the finished from full lines, Fig. 1. The parts are gripped in a two-jaw chuck and the large end is bored from the solid, reamed, recessed and tapped and the outside taper turned, faced and threaded. The production from this setting is 55 pieces per hour.

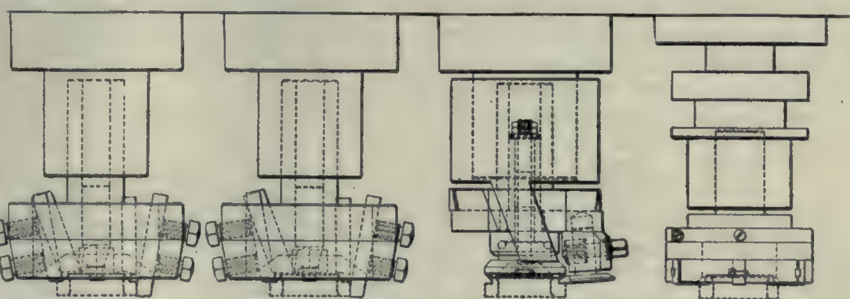


FIG. 8. TOOL LAYOUT FOR MACHINING SHRAPNEL SOCKETS—SECOND OPERATION.

For the second setting the pieces are held in threaded draw-back collets which fit into the thread formed in the previous setting. The head and stem are turned and faced, and the stem chamfered and threaded. The production is 120 per hour, the finished weight of the part, 8 oz., and the tool cutting speed approximately 80 ft. per minute.

A special cross-cut head is used for necking back of the external thread as well as the tapped thread, both operations being performed simultaneously. The long outside taper thread and the tap, while of different pitches, are handled on the same spindle by the aid of a special die head.

Shrapnel Sockets.

Shrapnel sockets come for machining as solid brass forgings, the rough blank weighing 13 oz. The work is done on a four-spindle machine and consists in the first setting, Fig. 7, of facing, boring, recessing and tapping. The parts are gripped in a two-jaw chuck and the pieces are held on arbors located by the thread formed in the end. In the second setting, Fig. 8, three diameters are turned, the end formed and necked, and the outside threaded. The production for each setting is 120 per hour and the tool speed 116 r.p.m.

Time Fuse Nose.

The time fuse nose pieces, Fig. 1, are brass forgings and are finished at one setting, Fig. 9, in a five-spindle machine. The forgings are held in two-jaw chucks, and the operations consist of facing, forming, recessing and tapping the inside. A centreing spindle is installed oposite the loading position to straighten up the forgings before chuck jaws are tightened. Special jaws are also used having stops in the back to make front edge facing uniform. The fifth, and last spindle is fitted with a special counterbore to take a light cut over all surfaces which have to be held to close limits. While a production of only 225 per hour has been obtained on these pieces in brass, a production of 320 per hour is attainable when pieces are made of aluminum. The cutting speed is approximately 80 ft. per minute. The finished piece weighs 3½ oz.

Time Fuse Head.

The time fuse head blanks, Fig. 1, are of machine steel and weigh 15 oz. each. The machine on which the various operations are performed was originally built to special order for handling a second

operation on steel high explosive fuse heads. It is fitted with eleven spindles,

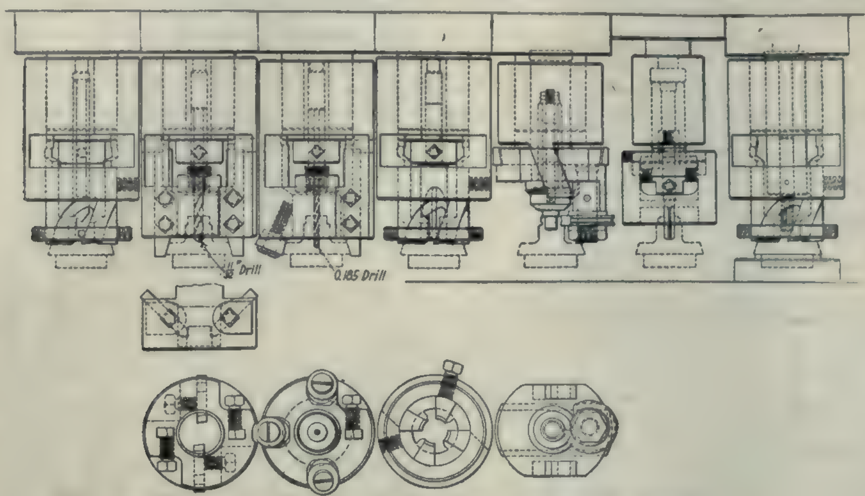


FIG. 10—TOOL LAYOUT FOR MACHINING TIME FUSE HEAD.

four of which are internal spindles operating inside of main spindles 1 to 4. The time fuse head parts are finished in one setting with tool sequence as shown in Fig. 10. They are threaded internally and externally and the ends are machined. The blanks are held on threaded draw back collets, afterwards being machined in the following order:—The hub is drilled, counterbored, tapped, turned on two diameters, necked and threaded, and the flange is faced, grooved and turned. The finished pieces weigh 13 oz. each. The production is 50 pieces per hour, and the tool-cutting speed approximately 40 ft. per minute.

4.7 Shrapnel Head.

A notable improvement falls to be recorded in the U.S. method of making shrapnel head from cold drawn steel stampings in place of making same from the bar or from forgings. In the first operation the pieces are centred on stop plugs which act as an accurate gauge for the thickness from the inside recess to

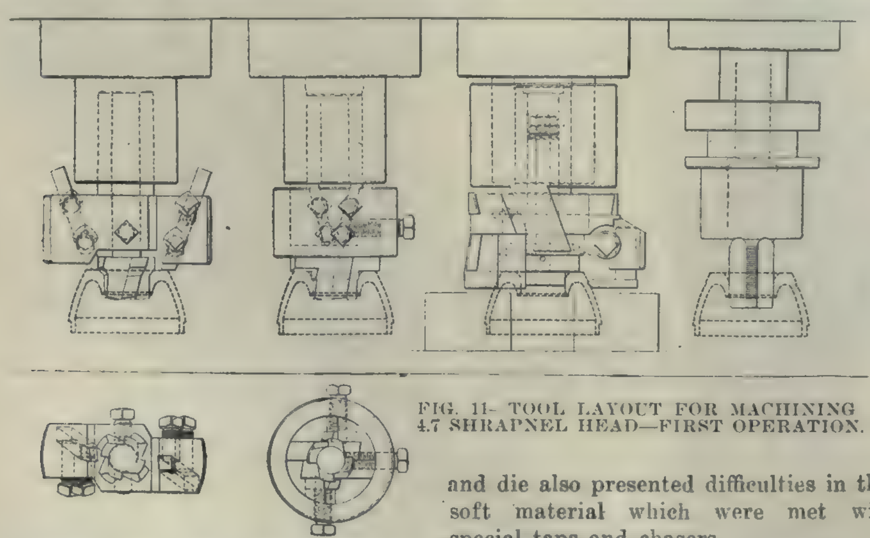


FIG. 11—TOOL LAYOUT FOR MACHINING 4.7 SHRAPNEL HEAD—FIRST OPERATION.

the finished face. The material employed permits of a high cutting speed (120 ft. per minute), with fine feed. The resulting quantity of tough, stringy chips which would be troublesomesome in ordinary turning are broken up by an interrupted movement of the facing and turning tools, Fig. 12. Threading by tap and die also presented difficulties in this soft material which were met with special taps and chasers.

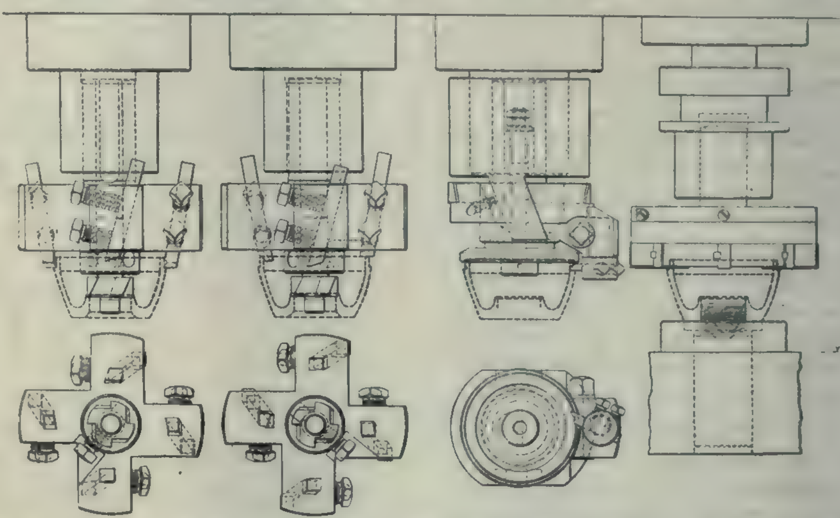


FIG. 12—TOOL LAYOUT FOR MACHINING 4.7 SHRAPNEL HEAD — SECOND OPERATION.

The 4.7 shrapnel head parts are cold drawn steel stampings, the blanks for which weigh 42 oz. each. The finishing is performed on a four-spindle chucking machine in two settings. For the first setting, small end Fig. 1, the pieces are held in two-jaw chucks arranged with stop plugs which fit quite snugly inside and locate them accurately. The operations consist of facing, chamfering, grooving, boring and tapping. The weight of the finished piece is 31 oz., and the production 62 per hour.

In the second setting the pieces are held on threaded drawback arbors by the thread formed at small end. The operations consist of facing, clamping, turning, necking, counterboring and threading. The production for this setting is 90 per hour and the cutting speed about 120 ft. per minute.

Time Fuse Plugs.

The time fuse plugs, Fig. 1, are brass forgings weighing 6 oz. each and the finishing is done on a standard five-spindle machine with specially designed tools, Fig. 13, which handles the forging from the solid. The small internal neck back of the tap presented difficulties for ordinary tooling but this was taken care of in a specially designed necking tool which performed the external necking as well as the internal. The thread and tap having different pitches were taken care of by a specially designed threading head. The finish form for seat was obtained by means of a circular forming tool.

The pieces are gripped in two-jaw chucks and the outside is turned, formed necked and threaded. The inside is formed out with hollow mills, drilled, counterbored, necked back to tap and tapped. The weight of the finished pieces are 3 oz. each, the production 180 per hour, and the approximate tool cutting speed 100 ft. per minute.

18 Pdr. H. E. Shell Head.

The blanks for the 18-pounder high-explosive shell heads are brass forgings

and weigh 34 oz. each. The finishing is performed in two settings, the pieces being gripped in two-jaw chucks. In the first setting, Fig. 14, the ends are faced and formed three diameters, then bored, recessed and threaded two diameters. A head has been specially designed for simultaneously cutting two threads of different pitches and the finish form is obtained through circular forming cutters which are stated to have long life. The recess inside back of the internal thread, is formed by a special cross-cut head on the third spindle and bearing a tool for the purpose, and this head has a diagonal sliding motion on a pair of fingers (one of which shows plainly). The head is backed by a powerful spiral spring which tends to keep it forced out-

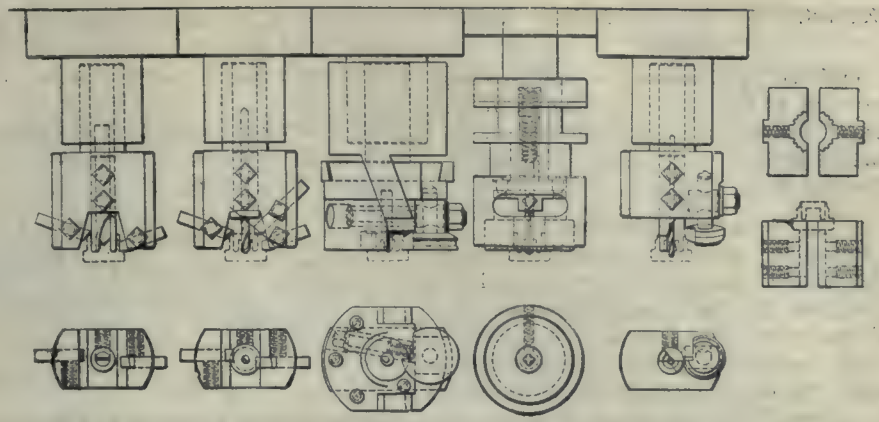


FIG. 13—TOOL LAYOUT FOR MACHINING TIME FUSE PLUG.

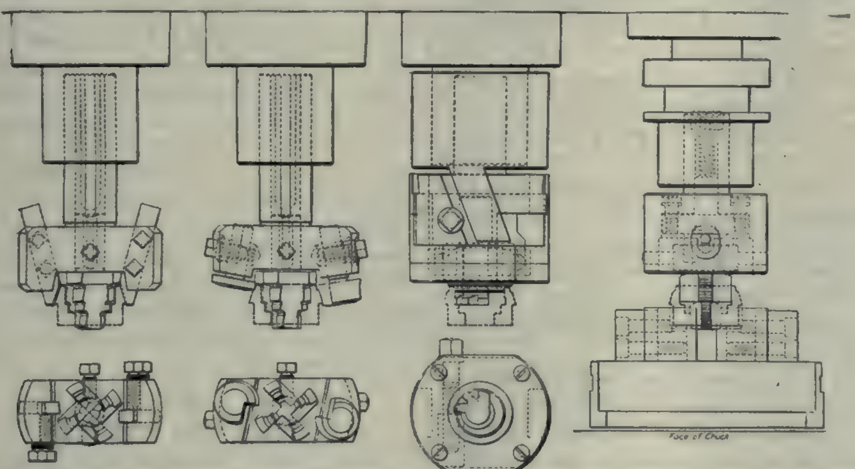


FIG. 14. TOOL LAYOUT FOR MACHINING 18-POUNDER H.E. SHELL HEAD—FIRST OPERATION.

ward. As soon as stop comes in contact with work, the head is forced backward. Its diagonal motion gives a lateral movement to the cutter which produces the desired recess. As soon as spindle starts to recede from the work, the head moves out and clears the tool. The fourth spindle carries a combination tap holder. The two internal threads are of different pitch but cut simultaneously. The holder is so designed that the smaller tap having a coarser pitch advances independently of the larger one.

For the second setting, Fig. 15, the pieces are held on threaded draw-back arbors and all tools with the exception of the die are piloted in the arbors so as to ensure perfect alignment and concentricity. The machining consists of facing, turning, necking and threading, and the production for each of the two operations is 120 pieces per hour. The weight of a finished piece is 28 oz., the tool speed is about 80 ft. per minute.

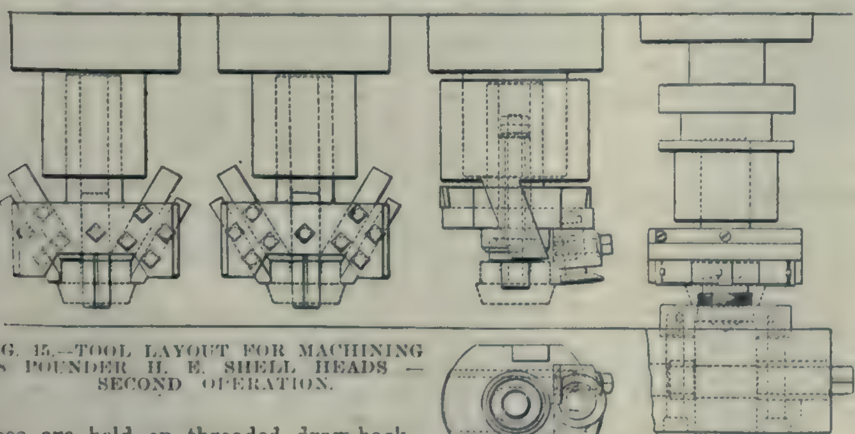


FIG. 15.—TOOL LAYOUT FOR MACHINING 18 POUNDER H. E. SHELL HEADS — SECOND OPERATION.

Rotary Cross-Cut Tool.

The rotary automatic cross feed tool is for cutting grooves back of threads and for internal and external cross cuts of any design. The tool is operated by the thrust of the work against two angular wedges and a cross-slide mechanism; the wedges being made with the proper angle to give fast or slow cross motion to the cutter head. This cross motion draws the cutter down into the work and when the work starts to back off a spring in the hollow spindle forces the cutter head out on the wedges and the tool out of the work. For internal work the head is of the same design but the cutter is placed on the opposite side and close to the centre.

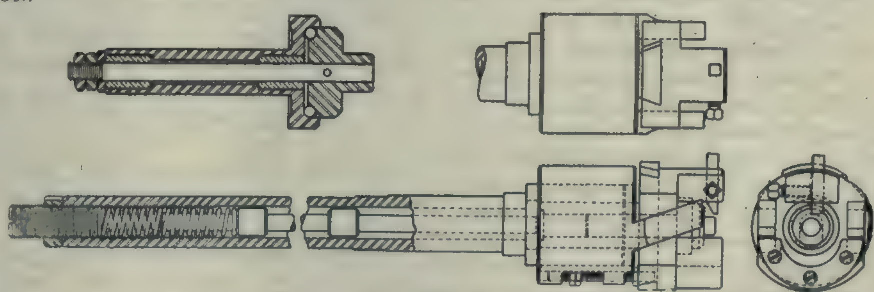


FIG. 16. ROTARY CROSS-CUT TOOL.

Sidney, N. S.—The new explosive base manufacturing plant in connection with the Dominion Steel Co., coke ovens for the manufacture of toluol, is now well under way and work is being rushed to have the buildings completed and ready for the reception of the machinery as soon as possible. The main building will be 44 by 60 feet, and 44 feet high. The plant also includes, with other details, three towers twelve feet diameter and fifty feet high, built in series, about four feet apart.

EXPLOSIVES IN MODERN WARFARE.

A TIMELY and interesting address on the "Use of Explosives in Modern Warfare," was recently given by Dr. J. B. Porter before the McGill University Chemical Society.

Classes of Explosives.

Explosives, said the lecturer, are usually divided into three classes, viz., low explosives, of which gunpowder is a typical example; high explosives, which must be essentially chemical, and represented by nitro-glycerine; and detonators, exemplified by fulminate of mercury. The difference in the rate of burning of members of the above classes is interesting. When gun-powder is allowed to burn in a loose train, the rate is about six feet per second. Nitro-glycerine will burn at the rate of about 16,000 feet per second, while fulminate of mercury, whether loose or compact, will burn at the rate of 20,000 feet per second.

Cordite.

Cordite, the standard explosive of the British army, is manufactured by dissolving guncotton in nitro-glycerine in varying proportions and adding a minute quantity of camphor as a preservative. This mixture forms a jelly, which is partially dissolved in acetone and drawn out into fine threads and wound on slowly rotating spools, whereby the acetone evaporates and leaves the cordite in the form of a dry thread. These threads are cut to size and used for the various purposes required.

Other powders used by the Austrians and Germans appear to possess greater initial velocity than cordite, but are not nearly as uniform. Cordite may be kept for a considerable time after preparation and will be found just as effective as a freshly-prepared sample, whereas the other powders seem to deteriorate in time. This feature of cordite gives it a premier position over other types. One disadvantage, however, accruing from the use of a cordite powder is a slight corrosive action upon a gun-barrel, especially if the cordite be moist.

Explosives for Shells.

In dealing with explosives for shells, the purposes involved must be considered, viz., whether the shell is to be a destructive or a shrapnel shell. The term destructive here implies the use of shells in the reduction of fortifications and for purposes of demolition generally. In a shell of this type melted picric acid is the active material used. This is known ordinarily as lyddite (English) and melinite (French).

A shrapnel shell is one which contains a large quantity of bullets and some suitable explosive to scatter the contents. In this case a smokeless powder is not desirable, as the artilleryman is able better to direct his fire by watching the smoke following the bursting of the shell. Such shells are equipped with time fuses.

For submarine torpedoes, compressed wet guncotton is almost universally used—fulminate of mercury serving as the detonator.

Rapid cutting explosive effects may be produced by using a so-called "necklace" of guncotton wound about the steel rail, bridge girder, etc., where the section is desired to be removed.

HEAT TREATMENT OF SHELLS.

By D. B. H.

I AM presenting here a few suggestions to those who are for the first time in their mechanical experience tackling a proposition entirely new to them—that is, doing work such as shrapnel shells, which, when finished, must stand a critical test, showing 100 per cent. efficiency.

To obtain those results they will find it necessary to banish the old system of working by rule of thumb. They must also eliminate the common forge, which has been a considerable handicap in producing efficiency in the heat treating of their former lines such as cutters, dies, punches, etc.

To be successful in shell manufacturing I would advise that you install along with other machines necessary for the work gas or oil furnaces, and you will, of course, require several of them for the heating, noseing, drawing, etc. To obtain uniformity and efficiency in the heating, I would suggest also the use of a four-record recording pyrometer, for by having this outfit you will have a continuous record of the temperatures in all your furnaces, and will make it absolutely certain that you are obtaining the proper results.

As the carbon content is the main element which regulates the critical point in steel, I would suggest that the manufacturer engaged in shrapnel work keep in close touch with the laboratory, so as to know that he has the right material to work with. By using care in working along the lines suggested there is no reason why the specifications required by the Government cannot be comfortably filled.

MUNITIONS OF WAR EQUIPMENT.

ONE feature of the multiplicity of equipment being installed for the production of munitions of war is that of the mechanically operated press as distinct from what is known as the hydraulic press. Large orders are being placed for the former both in Canada and the United States, one purpose being the manufacture of different sizes of brass cases for shrapnel shells of all three—British, French and Russian—type. One such equipment to our knowledge has recently been supplied to a leading Canadian Cartridge Co. by the E. W. Bliss Co., New York.

The latter firm, we have also discovered, have supplied a large number of automatic presses for the manufacture of lead composition balls for shrapnel shells, and among the interesting features to be observed in connection therewith may be mentioned the fact that some of these machines make 12 balls at one stroke, while another style of press, smaller in size, makes but one ball at a time. In both styles of machines the lead is fed in strips from reels, the entire operation of the presses being automatic.

We observe also that large quantities of special machinery for the manufacture of rifles is being furnished both Canadian and American factories whose business lies in that particular direction by the Bliss Co., and in these days, when quality product and quick delivery are of the very highest importance to those engaged in the manufacture of the actual implements of war, it is apparent that the above concern's experience in and facilities for building and delivering machine tools must necessarily be of a very high order.

COPPER AND THE WAR.

UNDER the above heading, a special correspondent to the "Times" quotes some most interesting figures, and makes some equally interesting deductions concerning the expenditure of copper necessary for the immediate use of the belligerents.

The writer conservatively estimates the number of rifles in use by the combined German and Austrian armies as averaging 1,300,000. At 20 rounds per man per day this means 26,000,000 shots for every 24 hours. A rifle cartridge weighs about 184½ grains, and this means that about 305 tons of brass is used daily for rifle fire. Adding 10 per cent. for the Maxims, the total becomes 335 tons. Of this only a small percentage is recovered, say, five per cent., which means a net expenditure of 318 tons.

For artillery fire it is estimated that the enemy use 150,000 shells per day, and this means 105 tons of brass per day. The copper in the brass forms 72 per cent. of the metal, and, therefore, the enemy require for this alone 309 tons of copper per day, or about 112,000 tons per year.

In time of peace, Germany can produce 26,000 tons per year, which, at the present time, might possibly be brought up to 36,000 tons per annum. After allowing for the small amount which Austria produces, the net deficiency amounts to 72,000 tons.

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Vol. XIII. MARCH 18, 1915 No. 11

PRINCIPAL CONTENTS.

MUNITIONS OF WAR MANUFACTURE.

THAT this many-nation-involved war was unquestionably thrust upon us, no better proof is necessary than the realization that in the fall of last year we were as an Empire what might aptly be termed shockingly unprepared for its advent; our fleet of course excepted. We are to-day, however, well past the unprepared stage, and who shall say otherwise than that now we are not only well prepared and in a position to maintain our accomplishment, but to rapidly and continuously improve on it.

Previous to the outbreak of war, business of every description throughout the length and breadth of our Dominion was more or less "under the weather," and, immediately following, enterprise of every kind round about us practically collapsed. The latter condition did not long prevail, however, for those at the head of affairs, even in spite of already heavy burden bearing, took hold of the Empire reins with the result that the wheels of factories at the Empire Heart itself began to revolve faster than ever before, as well as those of her Dominions, and such other countries as displayed the necessary good sense and appreciation of the circumstances.

It is an often heard remark, that we Canadians are at a loss to know what would have become of us had these prolific munitions of war orders not materialized. The prevailing opinion, and possibly a quite natural one is that almost every department of industrial enterprise would have ceased to be. Just why, however, we should incline to dote on what might have been, had the already mentioned war-equipment-for-war-pursuit orders not materialized, we are at a loss to know, except that the panic and stage fright engendered last August is being to some extent still nurtured.

It is not a question of what Canada would have done, and may not necessarily even be a matter of contentment with and gratitude for what she is getting to do as a result of the war. The question is more really—are we getting all we might and perhaps should, and, if not, is it because we are not getting after all that is going and are indifferent in the matter of equipping ourselves to but do it? We understand for instance, that orders for many thousands of aluminum fuse caps for shells are awaiting being placed when their manufacture is ready to be taken advantage of by some of our enterprising concerns, and while we do not in any sense aver that a surprisingly high percentage of the equipment being supplied the Allies by the United States could have been manufactured equally as well in Canada, we do think that a few additional lines and an increased contribution to those already being produced would not come amiss.

Our machine shops and machine tool manufacturers have benefited in large measure from the placing of shell orders, but the disposition to treat the work as being only of a temporary or stop-gap nature, here also militates against going into the business whole-heartedly. None of us realize as perhaps we should the gigantic nature of the struggle in which our Empire with her Allies is engaged, nor do we, except in a very small way, appreciate the abnormal demand for war material.

Among other things more or less important, we trust the issuance of this Shell Number of Canadian Machinery will be timely in drawing attention not only to the work in progress, but to its still further pursuit and development.

In the matter of our supplementary and general articles dealing with munitions of war, in this issue, we have drawn from a number of already published statistics and take pleasure in acknowledging our indebtedness for the privilege. Further articles relative to shell manufacture, etc., will appear in immediately succeeding issues.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.10
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.10
Beams and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 9 50	$10 00
Copper, crucible	11 00	11 50
Copper, unch-bled, heavy	11 00	11 50
Copper, wire, unch-bled.	11 00	11 50
No. 1 machine compos'n	9 50	10 00
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 00	9 50
No. 1 brass turnings	7 00	7 25
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect Feb. 13, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal
Standard				
¼, ⅜ in.	64	49	....	....
½in.	69	58	....	....
¾ to 1½ in.	74	63	....	....
2 in.	74	63	70	59
2½ to 4 in.	74	63	73	62
4½, 5, 6 in.	....	....	72	62
7, 8, 10 in.	....	....	68	57
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	43	....	....
½ in.	63	52	....	....
¾ to 1½ in.	68	57	....	....
2 in.	68	57	64	53
2½, 3 in.	68	57	67	57
3½, 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	65	55
7, 8 in.	....	....	61	50

Wrought Nipples	
4 in. and under	72½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload	$16 50	$16 75
Electrolytic copper	16 25	16 50
Castings copper	16 00	16 25
Tin	54 00	56 00
Spelter	12 00	15 00
Lead	5 25	5 75
Antimony	21 00	25 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh.	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong Size Ins.	D. Ex. Strong Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.28
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 100-lb. kegs, per cwt	6.75
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.72
Linseed oil, boiled, single bbls.	0.75
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch.	$8.00
5/16 inch	5.35
⅜ inch	4.60
7/16 inch	4.30
½ inch	4.05
9/16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	30 & 5%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.40
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 80	$2 80
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 00	4 05
Apollo brand, 10¾ oz. (galvanized)	4 10	4 00
Queen's Head, 28 B.W.G.	4 50	4 45
Fleur-de-Lis, 28 B.W.G.	4 20	4 35
Gorbal's Best, No. 28	4 50	4 55
Viking metal, No. 28	4 00	4 10

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., March 15, 1915.—The iron and steel markets have been very quiet during the last week. The recent rail orders secured by the Algoma Steel Corporation from the Illinois Central have created more or less interest. In other mills, however, no new business has been reported, although they already have quite a considerable number of orders on their books. Pig iron is very dull, and is only moving in small lots. Machine tools are also generally dull. The metal markets keep firm but quiet.

The Steel Market.

Last week, 25,000 was the tonnage of rails reported to have been ordered by the Illinois Central from the Algoma Steel Corporation. The exact tonnage has since been officially stated, however, to be 35,000 tons of 90-lb. open hearth steel rails. An interesting feature of the situation is that our Canadian mills have been able to get this business. Recently a Canadian railway purchased rails from the Algoma Steel Corporation. These had to pass the rigid inspection of the "nick and break" test and their quality was so high that such a crucial test did not increase the normal number of rails rejected by less rigid tests; in fact, it acted slightly in favor of the mill. This order placed by the Illinois Central also carried with it the stipulation that all

rails were to pass the "nick and break" inspection.

Railways have been experiencing great difficulty in getting mills to have their products so tested. It is therefore all the more significant that the Algoma Company has allowed its product to be subjected to such a test and still has been able to meet the prices of American mills located on the Illinois Central Railway. These achievements go a long way to substantiate the claim of the Algoma mills that they turn out the best standard rails in America.

Pig Iron.

The pig iron situation changes but little from week to week. The prices all underwent more or less adjustment on the budget announcement, and since then no changes have been recorded. Orders being received are all of the small variety and the total volume of business passing is also small.

Machine Tools.

The demand for turret lathes and grinders still continues and the manufacturers are working hard to give early delivery. At the present time over 200 Canadian shops are engaged in making shells, and this has naturally created a hugs demand for certain classes of machine tool specialties. Heavy tools are not moving at all, and constitute stock which is very difficult to dispose of. The supply business is thriving on the war orders as the very best materials must be employed to secure accurate work.

Metals.

The metal markets have been extremely quiet. Practically no changes in prices are reported. Existing prices, are, however, firm. Several shipments of tin from London to New York have been reported and although the quantity in each is not stated, it is felt that delivery in New York will tend to ease the high price now being asked. Spelter is firmer, while copper is quiet. Antimony continues to be a scarce article, while aluminum is quiet.

Toronto, Ont., March 16.—The slight improvement in industrial conditions noted last week has been maintained, and the outlook is better. It should not be forgotten, however, that a considerable portion of the business that is now keeping the factories running is on account of military equipment, which does not necessarily represent actual development in the industrial field. On the other hand, it is a very useful substitute for normal business, which, under prevailing conditions, is conspicuously absent. When these orders have all been placed and completed there will be another period of adjustment pending a return to normal conditions. The higher tariff will no doubt eventually help Canadian manufacturers, but conditions at present are such that it is difficult to form a definite opinion as to what extent Canadian industries will benefit.

In the mechanical engineering field the recently-organized shell industry is the most important feature. The enormous demand for ammunition renders this industry of the greatest importance. Arrangements are now being made for the manufacture of shells of still larger calibre.

Indications do not point to any marked activity in municipal works this season. A difficulty in financing civic improvements is being experienced and fewer tenders are being called for material and equipment than is usual at this period of the year. The steel trade is quiet. The building trade is not showing any signs of revival, and many manufacturing interests are operating considerably under capacity. The metal markets continue to show strength, tin, spelter and antimony having advanced from 3c to 6c per pound. A revival in the machine tool trade is to be noted this week and considerable activity is anticipated on account of the orders for large calibre shells about to be placed.

Steel Market.

Conditions in the iron and steel trade are much the same as have prevailed during the past few weeks. There is, however, a beter tone in the market. The amount of steel being used for shells is increasing, and plants engaged in this business are very busy. The Algoma Steel Corporation of Sault Ste. Marie, Ont., has booked a further order for rails from the Illinois Central Railroad, making a total of 36,000 tons from that road alone. In addition, they have received an order for 80,000 tons from the C.P.R. The Algoma Mill has recently booked 60,000 tons from railroads in the States, including the Illinois Central. Prices as a rule are firm, and there are few changes to note. Wire nails are now being quoted at $2.35 base, representing an advance of 15c. The new discounts on cold-drawn steel shafting are 40 per cent. at mill, and 30 and 5 per cent. at warehouse. Galvanized sheets are very firm and liable to advance any time on account of the high price of spelter. Tin plate manufacturers in the Pittsburgh district have announced an advance equal to $3 a ton.

Pig Iron.

There is nothing of interest to note in the pig iron market except that the Victoria furnace at Port Colborne, Ont., may be blown in some time this month.

Scrap Metals.

The light demand for scrap continues, but prices are firm, especially copper and brass scrap. Heavy and tea lead have advanced ¼c, and are now being quoted at 4¼c and 3¼c per pound respectively.

Machine Tools.

Machine tool dealers report a better demand for shell-making machines, and a large number of enquiries have been received this week. These tools are for the larger calibre shells, and preparations for their manufacture are now being made. The tools most in demand are 16-in., 18-in. and 20-in. engine lathes and high power drilling machines. The shells range from the 18-pounder high explosive lyddite to the 6-in. shell. Some interesting business is expected, as there will no doubt be a very large number of concerns engaged in the production of these shells.

Supplies.

A better feeling prevails in the supply trade, although conditions are under normal. Prices on brass goods have been withdrawn until the lists have been revised. It is anticipated that the new lists when issued will show an advance all round. Most brands of tool steel have advanced, and there is a better demand for the best grades of high-speed steel. Linseed oil is up 1c per gallon, raw oil being now quoted at 72c and boiled at 75c per gallon. No change in the prices of steel and metallic tapes is contemplated for the present.

Metals.

The feature of the metal markets during the past week has been the sharp advance in tin, spelter and antimony, due to strength in the London market. Tin advanced 6c, spelter 3c, and antimony 4c per pound. All markets locally are firm, but the volume of business is comparatively light.

Tin.—Shortage of supplies of spot tin in London appears to have been the cause for the sharp advance of 6c. The market also has been excited over the tin situation as regards shipments. Tin is quoted locally at 56c.

Copper.—The market is irregular and the situation unchanged. The market, however, is strong in New York on a large export demand. Local quotations are firm at 16¾c for lake copper, an advance of ¼c per pound.

Spelter.—The market continues completely upset and demoralized, quotations being more or less nominal. There is no spelter offering locally. Quotations are now 3c higher at 15c per pound.

Antimony.—The antimony market continues very strong at the late advance, prices on Cookson's and Hallett's being entirely nominal. Antimony has advanced 4c, being now quoted at 25c per pound.

Lead.—The market is quiet, but firm, at unchanged prices. Lead is quoted locally at 5¾c per pound.

Aluminum.—The market is unchanged at 23½c per pound.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

TENDER forms, specifications and drawings have been received from D. H. Ross, trade commissioner, Melbourne, for equipment required by the Victorian State Railway, particulars of which together with the closing date being briefly outlined as follows:

Contract.	Date Closing.	Equipment.
28,453.	April 21, 1915	—Hollow chisel mortisers.
28,467.	April 28, 1915	—Twelve storage battery trucks.
28,523.	May 5, 1915	—1,000,000 steel spring washers.
28,533.	May 5, 1915	—Electrical switches, voltmeters, etc.
28,558.	May 19, 1915	—1,600 dust-shields for axle boxes.
28,561.	May 19, 1915	—Pneumatic moulding machine.
28,562	May 19, 1915	—Four high speed drilling machines.
28,463.	June 2, 1915	—Electric lighting materials.

The departure of mails from Vancouver and San Francisco, in respect to the Victorian railway tenders, are indicated thus:—

From Vancouver, March 17, due Melbourne, April 10.

From SanFrancisco, April 13, due Melbourne, May 4.

From Vancouver, April 14, due Melbourne, May 8.

From San Francisco, May 11, due Melbourne, May 31.

French Government Inquiry.—Advices from Ottawa state that the following materials will be needed in France for reconstruction work of all kinds:—Lumber, squared and logs, for frame work and joinery; sectional iron and steel for frame and railways; machine tools for timber; machine tools for iron; metallic bridges and frames, fixed and adjustable; lumber bridges and frames, fixed and adjustable; lifting apparatus, such as cranes, trucks, crabs, etc.; tools for earth-work, quarries, pile-drivers, such as steam clams and shovels, perforating machines, mining crowbars, shovels, picks, etc.; tools for the crushing of stone; tools for the manufacture and utilization of mortar and concrete; transportation material used on public works, stock yards, such as wagons, portable railroads, locomotives and locomobiles, auto trucks and carts, wheelbarrows, etc.

A. P. Scott, lately metallurgical engineer of the Dominion Iron & Steel Co., Ltd., of Sydney, N.S., has severed his connection with that company and will shortly remove to Montreal where he will locate as a consulting metallurgist. Mr. Scott is well known in Montreal and has had a wide experience in American and Canadian iron and steel works.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Cancoma.

British West Indies.

E. H. S. Flood, Bridgetown, Barbados, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Canacom.

Harrison Watson, 72 Basinghall Street, London. E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbegod No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Ottawa, One.—The Cowie & Moore Co., engineers, contemplate erecting a machine shop.

Winnipeg, Man.—A fire at the plant of the Manitoba Welding & Mfg. Co., on March 6, did damage which estimated at $3,000.

Sidney, C.B.—The Dominion Steel Corporation will install a plant for the utilization of by-products of the coke ovens to manufacture tutol and benzol.

Toronto, Ont.—At a meeting of the Boving Company, of Canada, Ltd., held here on March 6, it was decided to wind up the business in Lindsay and close the factory up after filling all the orders on hand at the present time.

Fredericton, N.B.—The water pumping station plant and building and T. R. Kent Co.'s drilling plant at the Dominion experimental farm of this city, were totally destroyed by fire on March 11. The loss is estimated at $80,000.

Ottawa, Ont.—A central heating system for the Court House and County Jail on Nicholas street, is practically assured, and work on the installation of the new system is expected to be started during July or August of this year. The installation is expected to cost between eight and ten thousand dollars. The Carleton county council has the matter under consideration.

Montreal, Que.—The Harbor Commissioners new elevator will be begun just as soon as the spring comes. The contract for the foundations has been awarded, and as soon as the concrete base is in position work will begin on the superstructure. The new elevator will be erected immediately west of No. 1, and will increase the capacity of that one to about 1,800,000 bushels as the addition will be large enough to hold three quarters of a million bushels.

Electrical

Regina, Sask.—The Canada West Electric Co. contemplate building a factory here to cost $3,000.

Petrolea, Ont.—According to Engineer J. J. Jeffery, of the Ontario Hydro-Electric Commission, Petrolea, Oil Springs, Wyoming and Sarnia will have hydro power within the next few months

Newmarket, Ont.—About ten tenders have been received for transformers, meters and wiring for the extension to the local electrical system.

Toronto, Ont — Ontario Hydro-Electric Commission will start work in the spring on the proposed power canal from Chippawa creek to Queenston, where a large generating plant is to be constructed.

Hamilton, Ont.—The Hydro Board has announced a new scale of rates for light and power, which amount to about 10 per cent. less than the former rates. The old lighting charges were 4 cents per 100 square feet and 3 cents per k.w. hour, and are now 3 cents per hundred square feet and 2½ cents per k.w. hour.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Merchants Power Co.—The annual meeting of Merchants Light, Heat & Power Co., which is controlled by the interests represented in Cedars Rapids Manufacturing & Power Co., was held recently, and resulted in the re-election of the Board of Directors. The directors and officers are: J. S. Norris, president; H. Murray, vice-president; D. Lorne McGibbon, R. M. Wilson, Julian C. Smith, directors, and James Wilson, secretary.

Cedars Rapids Board.—Two new members have been added to the Board of Directors of Cedars Rapids M. & P. Co., namely, Sir Herbert Holt and Mr. Norton Otis, of London. The board and officers of the company are now as follows: —President, J. E. Aldred; vice-president, Howard Murray; general manager, J. C. Smith; superintendent of operation, R. N. Wilson, and Sir Herbert S. Holt, J. S. Norris, D. Lorne McGibbon, Arthur V. Davis and Norton Otis.

General Industrial

Zurich, Ont.—The Zurich Flax Co. have sold their mill to Arnold Heideman.

Bedford, Que.—The Bedford Mfg. Co., will probably re-build their factory providing more adequate fire protection.

Lethbridge, Alta.—It is stated that the C. P. R. has lodged an injunction against the removal of the Knight Sugar Co. plant from Raymond, Alta., to Layton, Utah.

Toronto, Ont—Fire on March 14 totally destroyed the plant of the Wagstaff Brick Mfg. Co. The company carried no insurance. A. H. Wagstaff is manager.

Guelph, Ont.—At a meeting of the direcfors of the Sterling Rubber Co., recently, it was decided to erect an addition to the building at once in order to meet the requirements of the rapidly growing trade of the company.

Guelph, Ont.—A deal has been completed by some local capitalists whereby they will take possession at once of the Raymond manufacturing plant, which has been lying idle for almost a year. J. G. Sully of this city is interested in the new company, which will make sewing machines.

Sherbrooke, Que.—The terms of the lease between the City of Sherbrooke and Julius Kayser & Co., the New York silk glove manufacturers, who are establishing a branch of their business here, have been agreed to by the city council. The company is leasing the building on Frontenac street known as the "Water Power Co. premises," for a period of three years.

Montreal, Que.—The Canada Consolidated Rubber Co. have decided upon a million-dollar preferred stock issue. The proceeds of the new issue will be used to increase the equipment at the Berlin tire factory, enlarge the department for the complete manufacture of rubber

clothing, recently established, provide funds for the installation of certain machinery in connection with the reclaiming plants, which are to be reopened immediately and strengthen the company's position generally.

Municipal

Ottawa, Ont.—The proposed incinerator is estimated to cost $13,000.

Welland, Ont.—The county council has decided to build 45 miles of good roads this year. The cost is estimated at $200,000.

Grimsby, Ont.—On the recommendation of Fire Chief Walker, the council has decided to purchase a 60-gallon chemical engine.

Vancouver, B.C.—A by-law for $230,000 for waterworks purposes will be submitted to the ratepayers in the near future. F. L. Fellowes, city engineer.

Owen Sound, Ont.—The city may build a half million bushel grain elevator and go into the business as a municipal enterprise.

Hespeler, Ont.—A by-law will be voted on by the ratepayers on March 29, to grant a fixed assessment of $64,000 to the Stamped & Enamelware Co.

London, Ont.—If the city accepts Engineer Willis Chipman's recommendation for the present year's work, there will be an expenditure of $211,000 on storm sewers.

Aylmer, Que.—The Provincial Government has approved of the by-law for the extension of the intake pipe. Tenders will be called for the building of the pump house.

Bedford, Que.—The council are contemplating installing a waterworks system. A by-law will be submitted when the cost has been estimated. Marvin Smith is the mayor of Bedford.

Bridgeburg, Ont.—The town council may instal a motor-driven pump with a capacity of 500 gallons per minute. A larger intake pipe may also be necessary.

Lindsay, Ont.—An effort is being made to have the Boving by-law submitted again to the ratepayers. A previous by-law to guarantee the company's bonds for $30,000 was defeated recently.

Ottawa, Ont.—J. B. McRae, engineer for the insurers' Committee of the Board of Trade, appeared before the waterworks committee at the request of the chairman and gave it as his opinion that the overland pipe to Lemieux Island construction will begin within fifteen days.

Chatham, Ont.—At a meeting of the Board of Trade, held on March 11, it was decided to start out on an active campaign to advertise the superior advantages of Chatham as an industrial centre.

Port Arthur, Ont.—The by-law bringing all electrical utilities under the new commission on March 5, was carried by a large majority. The majority was 368 and the poll stood 445 votes for the commission and 77 votes against other utilities than the hydro-electric one coming under the commission.

Hamilton, Ont.—In the supplementary estimates for Ontario, provision is made for the following improvements to public buildings in this city: Normal school, motors for ventilating fan and installation, $600; hospital for the insane, additions, alterations and repairs to steam and electric plants, plumbing and machinery, including engineers' supplies, $5,500; electric elevator, main building (part revote), $1,000; water service, $2,500.

Railways-Bridges

Toronto, Ont.—The Toronto Suburban Railway Co. have taken out a permit for the erection of a new transformer station, to be erected on Bay Street, at a cost of $4,500. Tenders will be called for immediately.

Toronto, Ont.—Works Commissioner Harris has asked the Committee on Works for authority to advertise for tenders for the steel bridge to be erected in connection with the proposed roadway through Mount Pleasant Cemetery. The cost is estimated at $40,820.

Otawa, Ont.—A new measure, introduced by Mr. Stewart, of Hamilton, before the Railway Committee confirms an agreement amalgamating the Toronto, Hamilton, and Buffalo Railway Co., and the Erie & Ontario Railway Co., with powers subject to the Railway Act, to raise $15,000,000 for the construction of branches and wharves and the purchase of vessels and rolling stock. Under the act the amalgamated company could construct a network of electric railways.

Trade Gossip

Canal Charter Extended.—The House of Commons last Friday gave the third reading to a bill to extend the charter of the Georgian Bay Canal.

The A. B See Electric Elevator Co of Canada, Ltd., Montreal, has been awarded a contract for two freight elevators in the examining warehouse at Quebec, by the Department of Public Works.

The Steel Company of Canada will remove the Toronto city office about April 1 from 69 Bay street to the ninth floor of the Traders' Bank Building.

Sherbrooke, Que.—The Board of Trade has appointed a committee to look into the advisability of sending a representative to London for the purpose of securing orders for the steel and iron industries of Sherbrooke.

Metals Chemical, Ltd., has been incorporated at Ottawa, with a capital of $1,000,000 to take over the business of Metals Chemical Co., Ltd., of Welland, Ont. The company who smelt and refine cobalt, nickel and silver propose to extend their plant.

The Turbine Equipment Co, Ltd., Toronto, have sold to the John Ver Mehr Engineering Co., also of Toronto, the following motor driven De Laval centrifugal pumps: one 2-million gallons, two 1 million gallon, and two 500,000-gallon capacity.

"Made in Canada" Campaign.—Mr. William P. Fitzimonds, industrial commissioner of the G. T. R., states that he is already the recipient of a large number of communications from United States manufacturing companies requesting information regarding suitable sites for the location of Canadian factories, and for information as to the progress which the new campaign is making in the Dominion.

Smith's Falls, Ont.—A new power company has been formed at Merrickville with a capital of $80,000, the organization meeting being held at that place on March 9, when the following officers were elected: G. F. McKimm, president; R. W. Watchorn, sec.-treas., and Messrs. A. L. Mills, T. F. Kyle and Alex. Mills, directors. The new power house is fast nearing completion and will be at once modernly equipped.

The E. H. Mumford Co., incorporated in May, 1905, when E. H. Mumford resigned as secretary and treasurer of the Tabor Mfg. Co., Philadelphia, is again engaged in the molding machine business, with headquarters at Front and Franklin Streets, Elizabeth, N.J. A complete line of molding machines is being designed and manufactured to meet the requirements of the foundry trade, and, while these will be interchangeable with previous types of Mumford machines, they are to be redesigned to meet every requirement of latter-day molding machine practice. By a singular coincidence Mr. Mumford is again taking up the molding machine business at the same

place where in 1895 he joined Harris Tabor in the development of the first vibrator molding machine.

New Incorporations

Metals-Chemical, Ltd., has been incorporated at Ottawa, Ont., with a capital of $1,000,000 to manufacture chemicals and other preparations at Toronto, Ont. Incorporators: W. Gilchrist, H. Stewart, and V. Hughes, all of Toronto, Ont.

The Deakin Construction Co., has been incorporated at Ottawa, Ont., with a capital of $50,000, to carry on business as builders and contractors at Montreal, Que. Incorporators: E. E. Howard, J. DeWitt and H. C. McNeil, all of Montreal, Que.

The Standard Valves Co. has been incorporated at Ottawa, Ont., with a capital of $50,000, to manufacture all kinds of heating and cooling apparatus, automatic or otherwise, at Ottawa, Ont. Incorporators: W. H. Wallace, H. Burnet and E. P. Cameron, all of Ottawa, Ont.

Canadian Electric Time Switch Co., has been incorporated at Toronto, Ont., with a capital of $100,000, to manufacture electrical apparatus of all kinds at Toronto, Ont. Incorporators: J. J. Greenan, H. D. Anger and R. D. Hume, all of Toronto.

The London Mfg. & Machinery Co., has been incorporated at Toronto, Ont., with a capital of $45,000, to manufacture machinery, tools, ammunition, etc., at London, Ont. Incorporators: H. F. Whetter, M. C. Grant, and G. J. McCartney, all of London, Ont.

The Standard Valves Co. has been incorporated at Ottawa, Ont., with a capital of $50,000 to manufacture all kinds of heating and cooling apparatus at Ottawa, Ont. Incorporators: Hugh Burnet, W. J. Wallace and J. Baird, all of Ottawa, Ont.

Newray Mines, Ltd., has been incorporated at Toronto, Ont., with a capital of $1,000,000 to develop mineral lands and deposits. Head office at Toronto, Ont. Incorporators: J. T. White, H. Ferguson and K. W. Wright, all of Toronto, Ont.

Universal Electric Co., has been incorporated at Toronto, Ont., with a capital of $100,000, to manufacture electrical apparatus of all kinds at Toronto, Ont. Incorporators: J. G. Greenan, H. Dell Anger and R. D. Hume, all of Toronto, Ont.

The Ingersoll, Packing Co., has been incorporated at Ottawa, Ont., with a capital of $1,000,000, to carry on business as packers at Ingersoll, Ont. Incorporators: C. C. Lumsden Wilson, J. H. Thomas and C. H. Sumner, all of Ingersoll, Ont.

The Dominion Truck & Transportation Co. has been incorporated at Toronto, Ont., with a capital of $1,000,000 to manufacture transporting and weighing devices at Toronto, Ont. Incorporators: J. M. Forgie, H. Riley and R. H. Green, all of Toronto, Ont.

The Hungerford Talc Co. has been incorporated at Toronto, Ont., with a capital of $50,000 to develop mineral lands and deposits. Head office at Toronto, Ont. Incorporators: W. H. Wallbridge, Toronto, Ont.; Harry B. Hungerford and M. B. Orde, all of Chicago, Ill., U.S.A.

Ontario Wrecking & Construction Co. has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on the business of all kinds of wrecking and building operations at Toronto, Ont| Incorporators: Maurice Goldstick, C. Lurie and B. Alexandroff, all of Toronto, Ont.

The Axle Valve Co. has been incorporated at Ottawa, Ont., with a capital of $200,000 to acquire the Canadian rights in an invention known as the Axle Valve, a mechanical device for lubricating axles. Head office at Montreal, Que. Incorporators: H. J. Trihey, P. Bercovitch and E. Lafontaine, all of Montreal.

United Shoe Machinery Co., of Canada, Ltd., has been incorporated at Ottawa, Ont., with a capital of $1,000,000 to take over the business of the United Shoe Machinery Co., at Montreal, manufacturers of boot and shoe machinery. Incorporators: F. W. Knowlton, E. M. McDougall and Gilbert S. Stairs, all of Montreal, Que.

Contracts Awarded

St. John, N.B.—The Phoenix Foundry has received a large order for shrapnel shells.

T. McAvity & Sons, Ltd., St. John, N.B., have been awarded a contract for brass plugs for shrapnel shells.

Vancouver, B.C.—The Vancouver Engineering Works have been awarded a contract by the city for the supply of a number of castings.

Peterborough, Ont.—The Wm. Hamilton Mfg. Co. have received a large order from the British War Office for the manufacture of 35-pound lyddite shells.

Winnipeg, Man.—The contract between the Northern Electric Co. and the city for 2,500 feet of copper cable wire has been approved, also that of the McClary Manufacturing Co. for street name-plates.

Newmarket, Ont.—The Canadian General Electric Company were last Monday awarded the contract for the supply of wire, some 23,000 feet, together with the transformer and other necessary equipment for the transmission of power for which contracts have already been entered into with the Metropolitan Railway Co. The equipment will cost about $12,000.

Hamilton, Ont.—The following contracts have been awarded for the city's supplies for the year:—Valves—Kerr Engine Co., Walkerville; hydrants—Brown, Boggs Co., Hamilton; pig lead and lead pipe—Tallman Brass Co., Hamilton; cast iron extension boxes—Forewell Foundry Co., Berlin; gray iron castings—Canada Iron Corporation; cast iron pipe and special castings—Gartshore, Thompson Co., Hamilton.

Ottawa, Ont.—The following contracts for supplies have been awarded by the city:—Brasswork, H. Mueller and Mfg. Co., Sarnia, $2,435; special pipe castings, C. M. Maas & Co., Ottawa, $3.25 per cwt.; lead pipe and pig lead, McKinley & Northwood, $6,605; oils and grease, Imperial Oil Co., $849.75; cast iron pipe, National Iron Works, Ltd., of Toronto, $64,455.65; valves, divided between McDougal's, Limited, and The General Supply Co., of Ottawa, Ltd.

Tenders

Welland, Ont—Tenders are being called for the installation of a fire-alarm system. J. G. MacMillan, chairman water commissioners.

Victoria, B C.—Tenders will be received up to Monday, April 5, 1915, for the following water meters: 25 1-inch, 10 1½-inch, 12 2-inch, 3 3-inch, 1 4-inch. Specifications may be seen at the office of W. Galt, the city purchasing agent.

Fredericton, N.B.—Tenders will be received at the Department of Public Works, Fredericton, until March 31, 1915, for constructing the steel superstructure of a new bridge, to take the place of the present wooden highway bridge at Moncton over the Petitcodiac River; one through fixed riveted steel truss span of 355 feet from centre to centre of end bearings; four through fixed riveted steel truss spans of 261 ft., 6 in. from centre to centre of end bearings, according to plans and specifications to be seen at the Public Works Department, Fredericton, N.B. John Morrissy, Minister of Public Works.

Vancouver, B.C.—Tenders will be received up to March 31, for the supply

A Page with our Readers

THIS IS OUR SHELL NUMBER! It is the first we have ever issued, and, we hope, the last.

The majority of our largest metal-working shops are now engaged in the manufacture of Shrapnel. Ploughshares are, almost literally, being turned into swords by tens of thousands.

This new industry was thrust upon Canadian manufacturers with startling suddenness. We hope that the very shells they are now turning out will be instrumental in bringing the conflict to a speedy close.

In the meantime the duty of the hour is to make shrapnel shells for the well-manned guns of the allied troops.

It is the business of Canadian manufacturers to turn out these shells as expeditiously and as EFFICIENTLY as possible, and in order to contribute to this efficiency we have issued a Shell Number.

In it our editors have gathered together a great deal of information pertaining to the actual operating methods adopted in various shops and by representative manufacturers.

In the advertising section will be found many lines of machine tools and equipment suitable for use in the economical production of shells, and every manufacturer needing additional equipment will do well to examine closely into the lines illustrated and described in this issue.

We would suggest that you preserve your copy of our Shell Number for reference purposes. The almost improbable requirement of to-day may prove to be the urgent necessity of to-morrow.

Anyway you will find this issue an interesting souvenir of the world's greatest war and of a time when Canadian machine shops were engaged in this most unusual industry.

of the following articles for the use of the B.C. dredging fleet at Vancouver, B.C., for 12 months ending March 31, 1916: Hardware; packings; Manila rope; wire rope; chain; steam pipe; valves and fittings; oils and greases; paint, paint oils, etc.; hose; brooms and brushes; steel castings. Forms of tender may be obtained at the office of G. B. Hughes, district engineer, Victoria, B.C.; at the office of C. C. Worsfold, district engineer, New Westminster, B.C.; and at the office of J. L. Nelson, supt. of dredges, 614-18 Birks Building, Vancouver, B.C.

Ottawa, Ont.—Tenders will be received at this office until Wednesday, April 7, 1915, for the construction of one new chain of buckets, tumblers, together with spare parts, for dredge "Mastodon." Plans, specification and form of contract can be seen and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of A. Kastella, Esq., mechanical superintendent, Birks Building, Ottawa, Ont.; J. L. Nelson, Esq., supt. of dredges, Vancouver, B.C.; G. B. Hughes, Esq., district engineer, Victoria, B.C.; C. C. Worsfold, Esq., district engineer, New Westminster, B.C.; F. Y. Harcourt, Esq., district engineer, Port Arthur, Ont.; J. M. Wilson, Esq., acting district engineer, Toronto, Ont., and A. E. Dubuc, Esq., district engineer, Montreal, Que.

Personal

J. T. MacNaughton, sales manager of the Dominion Steel Corporation, Sidney, C.B., was in Montreal recently on a business trip.

Sarnia, Ont.—Applications will be received for the position of city engineer vacant through the resignation of H. MacLean.

W. H. Hazlett, for 15 years with the British Columbia Electric Railway Co., has joined the firm of A. G. Langley & Co., engineers and contractors, Vancouver, B.C.

C. W. P. Ramsay, of the C. P. R., who has been appointed commanding officer of the Canadian Overseas Railway Construction Corps with the rank of lieutenant-colonel.

Michael Helbronner, partner in Pringle & Company, architects and engineers of Montreal, who rejoined the army directly after the war began, has been appointed engineer for a military district.

Lieut.-Colonel Lacey R. Johnson, heretofore general superintendent of the Angus Shops district, Montreal, who since he joined the C. P. R. in 1882, has been actively identified with the general uplift of ideals and service among the railroad employees, has been appointed general welfare agent of the company. This appointment has been made in order to co-ordinate the development amongst the employees of the road, with such organizations as the St. John Ambulance Association, the Safety First movement, the Railroad Y. M. C. A. and athletic associations.

Marine

Quebec, Que.—It is announced that the work on the new dry-dock at St. Joseph de Levis will be recommenced as soon as the weather permits. Messrs. M. P. and J. T. Davis are the contractors for the work.

Catalogues

Flexible Shafts for drilling, grinding and buffing operations are described in bulletin No. 54, being distributed by the Stow Mfg. Co., Binghampton, N.Y. These flexible shafts are shown in combination with electric motors and particulars are given of two types. The Stow two-spindle drill is also described.

Exide Batteries, type Z for motor cycle service, are described in a bulletin recently issued by the Canadian General Electric Co., Toronto. A full and detailed description is given of this battery covering its construction and lighting capacity. Tables are included giving the principal dimensions of each type.

Tumblers for foundries are described at length in a catalogue No. 113, recently issued by the Whiting Foundry Co., Harvey, Ill. A number of styles are illustrated and the principal features are stated together with tables giving the leading dimensions of each size and other data. Other illustrations show interior views of cleaning rooms with batteries of tumblers installed. Copies may be had free on request.

Brass Foundry Equipment. — The Whiting Foundry Equipment Co., Harvey, Ill., has just issued a new bulletin No. 114, dealing with equipment for brass foundries. Among the lines described are brass melting furnaces, cranes, crucible tongs, and tumblers. Each product is illustrated and tables give the principal dimensions. Copies will be mailed free on request to those interested.

Belt Conveyors.—The Jeffrey Manufacturing Co., of Columbus, Ohio, have issued a new belt conveyor bulletin No. 167. This bulletin contains 24 pages of interesting illustrations and descriptive matter which give a comprehensive idea of the wide variety and adaptability of the Jeffrey belt conveyer equipments for handling practically all kinds of ma-

terials. A free copy will be gladly sent to intending purchasers of elevating and conveying machinery.

Brass Foundry Equipment.—A new 48-page bulletin of more than ordinary merit is being distributed by Frederic B. Stevens, of Detroit, Mich., and Windsor, Ont. All equipment required in a brass foundry is dealt with in its pages, including furnaces, blowers, crucible tongs, core ovens, sprue cutters, magnetic separators, flasks, etc. Each line is illustrated and carefully described, and accompanied by dimensions where necessary. Special reference is made to the various types of crucible furnace using coke, gas or oil fuel.

The Jeffrey Mfg. Co., of Columbus, Ohio, have recently issued a new 48-page bulletin, No. 147, illustrating and describing the prominent features of their complete line of swing hammer pulverizers, giving full information regarding capacities, speeds, horsepower, general dimensions, etc. More than 1,000 of these machines are now in daily operation reducing limestone, shale, gypsum, clay, coal, coke, ores, tankage, bark, oyster shells, rock for road top dressing, and many other materials. A free copy of this bulletin may be obtained by writing to their home office.

Book Reviews

The Canadian Mining Manual for 1914, by Reginald G. Hore, editor of the Canadian Mining Journal, published by the Mines Publishing Co., Toronto. This is the first issue of the manual since it was taken over by the present publishers although several years have elapsed since its inception. The manual contains 273 pages, and gives much valuable and reliable information concerning the mineral resources and the mining industry of Canada. The opening pages are devoted to descriptions of the chief mineral products of Canada, giving particulars regarding location of the deposits and output for 1913. The illustrations in this section are colored to correspond with the natural color of the metal or mineral and form an interesting feature. The succeeding pages contain a series of reviews of the mining industry in the various provinces with the production for 1913. A list of mining companies operating in Canada is included with particulars of each concern. The concluding pages contain a list of Canadian mining companies arranged in order according to product. The manual is fully illustrated and will form a useful book of reference for those interested in Canadian minerals and the mining industry.

HINTS TO BUYERS

Some Jig Making Practice Considerations and Comment—II.*

By M. R. Lawrence, M.I. Mech. E.

We have come to look upon jigs and fixtures as such highly indispensable accessories to every class of mechanical engineering equipment manufacture that we may be apt in many cases to press them into service unwarrantably. The writer in this paper seeks to point out that their cost feature should be recorded carefully in every instance so as to ensure that they have been profitably applied, as well as being contributory to quality production.

IN Part I of this paper, which appeared in our March issue, jig cost and jig design were discussed at length, and an illustrated description given of the initial machining operations on a motor car cylinder and its crank case.

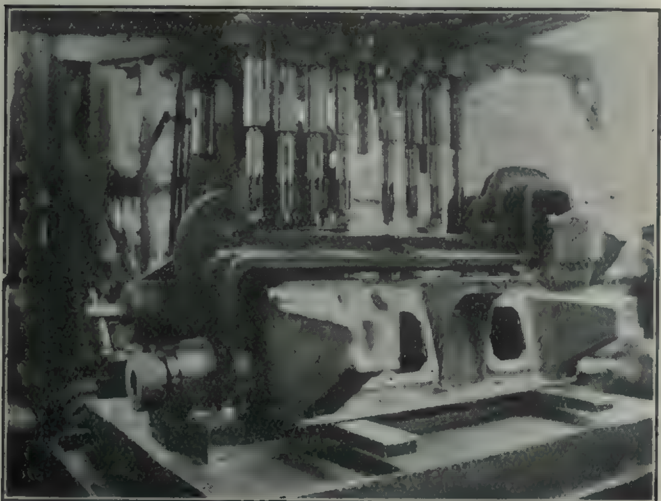


FIG. 9. DRILLING CRANK CASE.

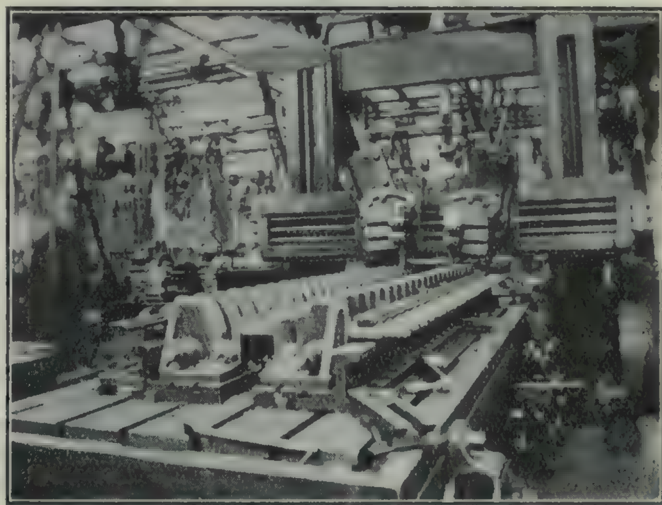


FIG. 10. GANG PLANING CRANK SHAFTS.

A continuation of the procedure relative to the latter is the immediately prominent feature to which attention is directed in the present instance.

The next operation (Fig. 9) illustrates the jig for drilling the cylinder holding-down bolts and the valve guide-holes. The casting is located in its jig by plug-gauges fitting the bore of the crank-shaft and the cam-shaft, and the taper wedges underneath are adjusted after these plugs are home, to take the pressure of the drills. The jig illustrated has had to be duplicated in order to deal with the quantity in the time, and, therefore, does not carry the cylinder bolting-down holes. This has no disadvantage, as this method of location ensures equal accuracy to both jigs. If any machined faces do not "clean up," or any other irregularities are observed after the castings come from the jigs, it is a clear indication that something is wrong, and that either the casting is of incorrect shape or has been improperly treated. It will then either be thrown out or receive special treatment.

While the machining of these pieces is in mind, the author wishes to call attention to the reason why the castings are dealt with singly, and not mounted on larger machines taking a number at one setting. It is a simple matter to set up one casting true to the scribed lines in this way within the accuracy required; but when more than one has to be mounted, a great deal more care must be taken, because each casting has to be true to the other as well as to the machine.

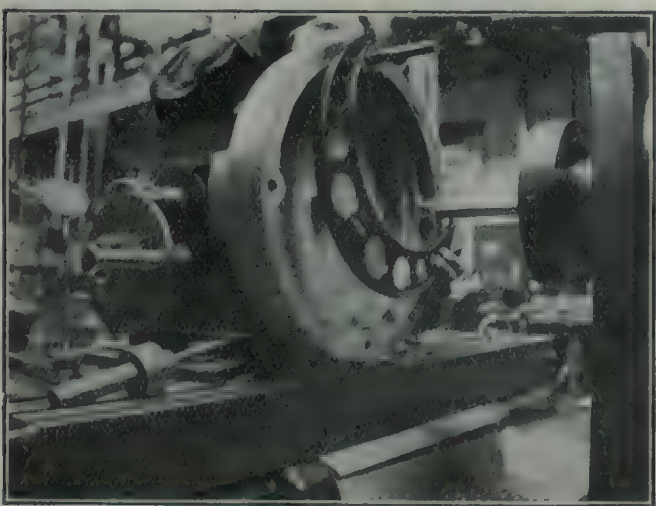


FIG. 11. SETTING OUT DRILL JIG.

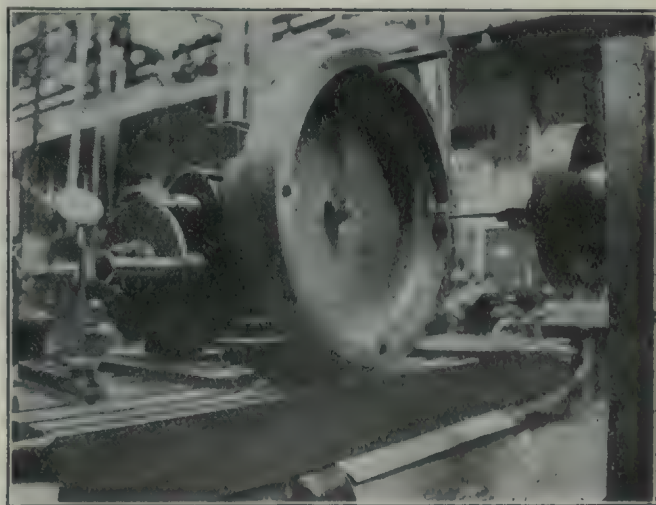


FIG. 12. BORING DRILL JIG.

*Paper read before the Manchester Association of Engineers, December 12, 1914.

It is far more economical to set them up singly on small machines suitably grouped, when two, three, or four can be tended by one operator. The capital outlay in plant, the floor space, the idle time when the cutters are not cutting, and, as a consequence, the operators' wages and the establishment charges, are all less. The only cases where grouping really pays is when the parts can be located from a previously machined face like that illustrated in Fig. 10. This shows a gang of four-cylinder motor-car crank-shafts on a planing machine. The time taken in setting is only that necessary to clean the locating faces and secure the parts.

By far the greater number of jigs that are used are made for correctly locating drilled holes. Figs. 11 and 12 illustrate a good method for making drill jigs where the holes are in circular relation. The illustration depicts a jig carrying four holes, and the method adopted is as follows:—The jig-casting is turned and mounted truly on a dividing-head on a universal milling-machine. One diameter, preferably an outside diameter, is turned accurately to a given dimension. On the cutter-spindle of the machine is mounted a self-centering chuck, in which a true mandrel of known diameter is mounted and set to run true. The table of the machine is then adjusted vertically until the cutter and dividing-head spindles are at the same height, a Vernier gauge being used to measure from the table to the mandrel for the purpose. The table is then adjusted sideways until the centres of the two spindles are the proper distance apart. A Vernier depth-gauge is used to measure from turned diameter of the jig to the true mandrel. A drill a few hundredths smaller than the finished holes is then chucked and the holes drilled, the dividing-head spacing them as desired.

An eccentric boring-bar holder, carrying a single-point cutter, illustrated in Figs. 13 and 14, is then chucked, and the first hole bored out to the desired size. The amount of eccentricity, and, therefore, the size of the hole bored, are readily adjusted by the use of a chuck-key. A plug-gauge is inserted, and the work divided to bring up the next hole. The true mandrel is again mounted in the chuck, and the micrometer used, as illustrated in Fig. 11, to adjust the jig to the exact position, thus eliminating any backlash or any imperfections which may exist in the dividing-head. The boring-bar is again inserted and the hole bored true. The same principle is employed for making a series of holes in line, the lead screw of the table being quite accurate enough on a good universal machine for approximate location for drilling purposes. The plug-gauge, true mandrel, micrometer, and little boring-bar are again used for final location.

FIG. 13. ECCENTRIC BORING BAR HOLDER.

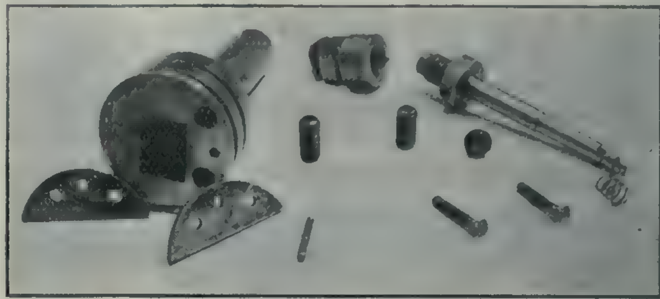
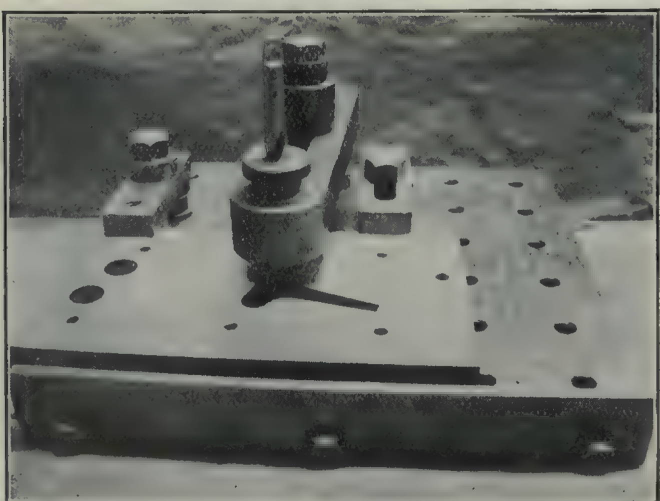
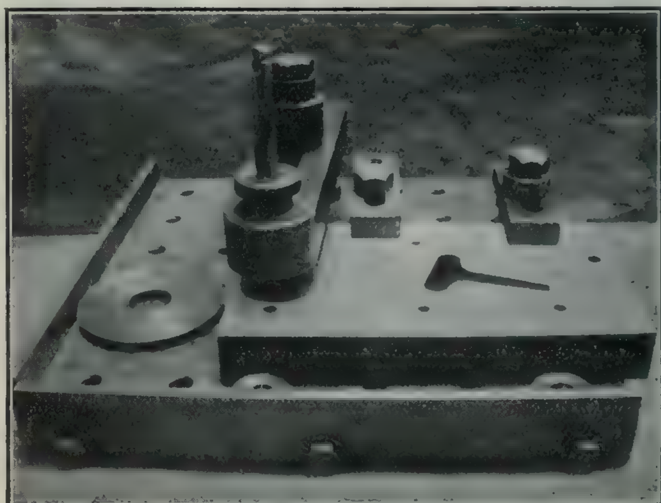


FIG. 14. PARTS OF ECCENTRIC BORING BAR HOLDER.

Another very useful device for dealing with the rapid production of drilling-jigs, where the holes are not in circular relation to one another, is illustrated in Figs. 15 and 16. The device consists in a cast-iron plate, about 18 in. square, planed all over, and has a number of holes drilled and tapped in it, as illustrated. Two sides are got up dead true and square to one another, to which are bolted two wrought-steel strips carefully machined. A slotted bar is provided, with a truly-ground hole and a series of slip-bushes. The jig is planed square on the two sides and on both faces, and the positions of the holes are roughly set out on it. The jig is then clamped up to one corner, the bush set over the position of a hole which is drilled and reamed through it. The jig is then moved to bring the next hole into position under the bush by placing two circular gauges upon the one side, and the third one upon the other. This hole is then put into the jig, and the position again altered for another, and so forth.





FIGS. 15 AND 16. FACE PLATE FOR SETTING OUT DRILL JIGS.

These methods have great advantages. It will be found that standard bushes can be almost universally adopted. They can be manufactured on a capstan or automatic machine from mild steel, and carbonized, hardened, and ground, and

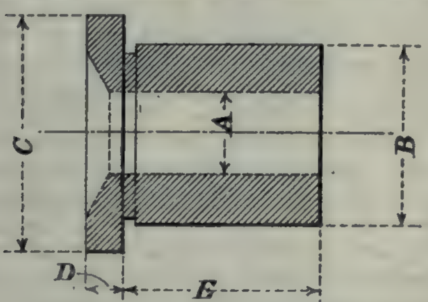
put into stores. With this little single-point boring-cutter it is quite an easy matter to bore the holes accurately to size and in the correct position. Suitable sizes adopted by the author are given in the following table:—

Cast Steel up to 1 in. Diameter Outside				Mild Steel Case-Hardened 1 in. and Upwards.			
A	*B	C	D	A	B	C	D
in.	in.	in.	in.	in.	in.	in.	in.
To ⅛	0.376	0 19/32	⅛	To 0¾	1.0015	1 7/32	5/32
" 3/16	0.4385	0 21/32	⅛	" 0 13/16	1.127	1 11/32	5/32
" ¼	0.501	0 23/32	⅛	" 0⅞	1.1895	1 13/32	5/32
" 5/16	0.5635	0 25/32	⅛	" 0 15/16	1.252	1 15/32	5/32
" ⅜	0.626	0 27/32	⅛	" 1	1.314	1 17/32	5/32
" 7/16	0.689	0 29/32	⅛	" 1 1/16	1.4395	1 21/32	5/32
" ½	0.7515	0 31/32	5/32	" 1⅛	1.502	1 23/32	5/32
" 9/16	0.814	1 1/32	5/32	" 1 3/16	1.5645	1 25/32	3/16
" ⅝	0.8765	1 3/32	5/32	" 1¼	1.627	1 27/32	¼
" 11/16	0.939	1 5/32	5/32	" 1 5/16	1.6895	1 29/32	¼

*Where possible.

Note.—All drilling and locating liners from 0 to 1 in. outside diameter to be marked "Cast steel, Hd and Gd; not like this: "C.S.Hd and Gd;" over 1 in. to be marked "C.H.S.Gd."

With these means at one's disposal, the cost of producing drill-jigs and, in consequence, the number of pieces for which it is worth while to make them, is very considerably reduced. They make easy the setting of piece-prices for such



STANDARD BUSHES.

work, because the time required to produce the holes in any jig can be estimated very accurately. Foremen and operators soon gain confidence to set and accept prices.

G. T. R. APPRENTICES' ANNUAL BANQUET.

THE tenth annual banquet of the apprentices in the motive power department of the Grand Trunk Railway System was held in the assembly of the company's shops at Stratford, Ont., on Thursday evening, March 18.

The gathering was the largest in the history of such functions, about 230 persons sitting down to the tables. The chairman, Robert Patterson, master mechanic, G. T. R. shops, Stratford, was flanked by the following: Mayor Barnsdale and H. W. Strudley, president of the Board of Trade, Stratford; J. Markey, master mechanic of the G. T. R. at Toronto; R. J. S. Weatherston, divisional freight agent; H. MacDougal, local freight agent; W. D. Robb, of Montreal, superintendent of motive power; W. M. O'Beirne, J. H. Gordon, A. M. Kay, Col. Wm. Lawrence; A. A. Maver, master mechanic of Montreal; Chas. McNair, Toronto; R. J. Leckie, London, and E. A. Meldrum.

An extensive toast list and musical program followed a most enjoyable supper catered by the Ladies' Auxiliary to the band, the orchestra of which furnished some delightful music during the repast.

Robert Patterson.

Chairman Robert Patterson was geniality itself as he referred to the occasion, the tenth annual banquet of G. T. R. apprentices and to the pleasure it gave him to officiate for the tenth time as chairman of such an enjoyable function. It came as a fitting close to a season of study. The apprentices had arranged every detail in connection with the banquet themselves, doing the decorating of the hall, arranging for the program and various other incidentials all of which had gone to make the gathering of 1915 one long to be remembered, and the fact that apprentices were present from Chicago to Maine was an indication of the interest being taken in it.

City of Stratford Toast

Mayor Barnsdale and H. W. Strudley, chairman of the Board of Trade, replied to the toast of the City of Stratford, which was taken after the toast to the King had been enthusiastically honored.

Mayor Barndale gave an interesting account of the early history of the G. T. R. in Stratford, commencing in 1870, when the shops were built, to be opened a year later. In 1875 or thereabouts a big sum was voted for the erection of a round house, and to the growth and prosperity of the city, since then, the mayor attributed the presence of the G. T. R.

H. W. Strudley took occasion to thank the apprentices on behalf of the Board of Trade of Stratford. As G. T. R. apprentices, he said, they had something in front of them. Our country was especially in need of technically trained men, and if all industries could work out an apprentice system like the G. T. R. there would be no dearth of trained employees.

There were too many people tilling the farmers in the West, remarked Mr. Strudley, and not enough tilling the soil.

W. D. Robb.

In a happily worded address W. D. Robb, of Montreal, superintendent of motive power on the G. T. R. thanked the apprentices for the opportunity given him of being present at such a unique banquet—unique owing to the fact that the youngest employees of the system had invited its officials to sit and dine with them. This, in his opinion, was an indication of the boys' appreciation of what the officers were doing for them, while the perfect harmony existing between G. T. R. apprentices and the company was bringing the best of results, a fact greatly appreciated by the officials, particularly among those in the motive power department.

"The Grand Trunk Railway System," said Mr. Robb, "had made advancement equal to that of any road on the continent. It is meeting the requirements of the public better than ever before." The motive power, asserted Mr. Robb, was in especially good condition and G. T. R. engines, he believed, were equal to any in America. No advancement in the various departments of the G. T. R., however, had been as great as that made by their apprentice system in which a previously undreamt of perfection had already been achieved. The company now possessed six hundred apprentices at different points in the system where they were proving to be, or would prove to be, the biggest asset the G. T. R. possessed.

The success of the system, however, did not belong to any one man, the master mechanics and instructors being all responsible. The future of the motive power of the G. T. R. was well assured by the talent continually coming forward in the shape of trained apprentices.

Superintendent Robb thought the public should back up the Grand Trunk in its request for higher freight rates. This, in the face of a business depression which the G. T. R. was feeling like other concerns, was a just request. The G. T. R. was simply marking time with the general depression. Ninety of his engines had been laid up, waiting for work, and the effects had been greatly felt all over the line. "There are no better indications of prosperous times than a railroad's prosperity," said Mr. Robb, "so that throughout the United States and Canada business is slack when the railroads are slack and business is good when the railroads are prosperous."

Motive Power Dept. Toast.

The toast to the Motive Power Department was responded to by A. A. Maver, of Montreal, master mechanic of the G. T. R. As a former Stratford resident he said he felt quite at ease, having pleasant memories of the city and its people. Going back reminiscently to 1888, over twenty-five years ago, when he first came to Stratford, Mr. Maver compared shop conditions of then and now. He thought the shops in Stratford were equal in design to any on the continent and, in closing, advised the apprentices to cultivate the habits of concentration and industry, to gain efficiency, the result being in promotion. "Second to none," he said, was the motto for the G. T. R. apprentices.

Other Toasts.

An ex-apprentice, J. R. Lekie, of London, locomotive foreman, took up the response to the ex-apprentice toast, and R. Huegli replied to that of "Our Apprentices." The toast of "Our Visiting Apprentices" was replied to briefly by Messrs. Percy Smith, of the Montreal shops, John Atkinson, of Battle Creek, F. Davis of Ottawa, S. Pearson of Toronto, and F. B. McDonald of Port Huron.

Our Soldier Boys.

Lieut.-Col. Wm. Lawrence and Pte. A. H. Janes of London camp, replied to the toast "Our Soldier Boys." Col. Lawrence referred to the good reports heard of the various contingents.

Private Jones, an ex-apprentice, expressed many patriotic sentiments and presented the thanks of his comrades, many of whom were present from London and also from Guelph, to Mr. Patterson for the occasion, closing with best wishes to the G. T. R. apprentices. A general expression of thanks to the Ladies' Auxiliary and others was included in a brief address by H. Thorne, secretary-treasurer of the apprentices' committee.

Musical Program.

The musical program included solos by A. E. Dodds and Jas. O'Donoghue, who also scored a distinct hit with a clever make-up skit with some talented crayon work; an excellent cornet solo by W. Tonge, a good instrumental piece by Messrs. W. Plummer and J. Millman, ex-apprentices, and trombone selections by Messrs. F. Deakin and G. Bexton. The accompanist was Mr. W. Choyce, and R. Choyce led in the singing of Tipperary at the finish. The orchestra was composed of W. Choyce, W. Pieper, Jas. Malone, F. Deakin, G. Bexton and D. McLennan.

The Committee.

The members of the apprentices' committee in charge of the banquet were: Messrs. A. Barnes, E. Davis, F. McDonald, W. Davis, G. Ewart, A. Dickson, W. Mitchell, G. Mavity, J. McArdle, W. Furey, A. Schaefer, A. McKenzie, R. Beadle, E. Townsend, and H. Thorne, secretary-treasurer.

Soldiers Present.

The soldiers up for the occasion from London and Guelph included: Sergt.-Major A. Holmes, Corporal D. Innes and Privates A. H. Jones, G. Kerby, D. McIntosh, H. Polley, W. J. Lyon, W. Marks, H. Vivian, T. Flannigan, A. Reeves, C. Borthwick and R. Allen, all from London, and Signallers G. Hudson and G. J. Day and Private C. Clarke of Guelph.

WELDING GALVANIZED AND TIN PLATES.

INQUIRIES are frequently made as to the possibility of obtaining satisfactory welds on plates or articles that have been galvanized or tinned. In most cases the welds obtained are excessively brittle, and in the case of welding galvanized material, the health of the welder is seriously affected by the fumes produced under the action of the blowpipe. It is therefore necessary for the welder to know the difficulties he has to contend with, and the methods to adopt in order to produce satisfactory welds on these materials.

Galvanizing.

Zinc forms a cheap and excellent protective coating for iron and steel. It has the great advantage over tin and lead in being attacked in preference to the iron when the two metals in contact with each other are exposed to corrosion. For most articles zincing—or galvanizing, as it is wrongly called—is most cheaply and conveniently applied by dipping the iron or steel articles in a bath of molten zinc. Previous to dipping the articles are cleaned by acid and friction, coated with a flux of sal-ammoniac and heated. With certain articles this method has disadvantages; for example, in large objects, tanks for instance, it is difficult to heat the molten zinc evenly, besides the bath would have to contain many tons of zinc. In these cases, the depositing of the zinc electrically, known as electro-zincing, has marked advantages. The zinc is deposited cold, and does not alloy appreciably with the surface of the iron to be protected.

The application of oxy-acetylene welding to finished galvanized articles is the exception rather than the rule. There are cases where, owing to the distance from a galvanizing plant, articles are constructed from galvanized plates and oxy-acetylene is applied during the construction. In other cases, the blowpipe is frequently applied to correct defects of manufacture, for example, welded or riveted tanks which have failed under hydraulic test. Lastly, the blowpipe is an indispensable tool for the repair of galvanized articles.

Galvanized Plate Welding.

In welding galvanized plates numerous precautions are necessary. The white jet of the blowpipe in contact with the plates produces abundant vapours and oxide fumes. These can interfere with the course of the work and, more important, seriously affect the health of the welder. Without proper preparation, the welds always include as impurities, zinc and slag, and the mechanical strength and soundness of the welds are directly dependent on the amount of such slag and zinc incorporated into the iron whilst molten.

The operation of hot galvanizing produces at the surface of the galvanized plate a layer of pure zinc and a series of intermediate alloys of iron and zinc, rich in zinc near the surface and rich in iron where the alloy comes in contact with the plate. As already indicated in describing the operation of cold galvanizing or electro-zincing, the zinc does not alloy appreciably with the surface of the iron. Under the action of the blowpipe the layer of zinc near the surface is volatilized, but this is not the case with the layer of alloy in contact with the iron or steel plate. Part of the alloy is dissolved in the iron, but the greater part forms a well-known earthy slag, and it is difficult to avoid its incorporation in the weld. The effect of including the zinc-iron alloy is to produce a very brittle weld, and the effect of incorporating the slag is to produce a defective weld with a consequent loss of strength.

Zinc Removal Imperative.

It is obvious that to produce good, sound welds on galvanized articles, it is necessary to remove the zinc from the vicinity of the weld. The zinc should be entirely removed for a distance of 1 in. to 1½ in. on either side of the centre line of the weld. This preparation makes the cost of the weld higher, and many firms neglect this precaution. Where the strength of the joint is of small importance, the direct application of the blowpipe may be sufficient. In such cases the health of the workman should be considered, and a suitable respirator be provided together with a plentiful supply of milk as an antidote. The plates should be bevelled as soon as the thickness reaches ⅛ in., otherwise burning of the iron and lack of penetration are sure to result.

The welding rod should be of Swedish iron, of dimensions appropriate to the thickness to be welded, and the power of the blowpipe should be that given for the welding of iron and steel plates of

identical thickness, that is, the hourly consumption of acetylene should be 240 to 320 litres (8½ to 11 cubic feet) for every ⅛ in. thickness to be welded. The removal of the zinc in the vicinity of the weld also removes the protective covering and it is not usual to replace it by re-galvanizing. The superiority of zinc over other protecting metal coatings is important in this case as it is possible for the exposed iron to be protected by the surrounding zinc. It is advisable, however, to clean thoroughly the welded parts and paint them with a protecting paint having an aluminium base.

Tin Plate Production.

Tin plates are sheets of iron coated with a very thin film of tin. The manufacture of tin plate consumes the larger part of the world's output of tin. The plates resist the corrosive action of salts and acids, and tinned articles are commonly met with in practice. The process consists in annealing, washing, pickling and rolling the plates to get a good surface, they are then coated with tallow or palm oil previous to dipping in a molten bath of tin. The tin readily alloys with the iron at the surface of contact, and a thin film of tin adheres to the alloy. Alloys of iron and tin, even when only traces of tin are present, are extremely brittle hot or cold.

Tin Plate Welding.

In the oxy-acetylene welding of tin plates, the tin is not eliminated as a vapor or as oxide fumes as in the case of zinc. Although tin melts at a low temperature (450 deg. Cent.), its vaporizing point is in the neighborhood of the melting point of steel (2,790 deg. Fah.), and further, the tin does not separate from the iron, but is entirely absorbed by the iron as soon as the latter reaches red heat, so that when the iron becomes melted by the blowpipe the iron-tin alloy is added to the molten bath. The result is that the weld consists of very large crystals, which are separated by numerous fissures or cracks.

In endeavoring to weld tin plates without preparation, the welder observes cracks forming behind the blowpipe during the execution of the weld. These cracks are produced by the expansion and contraction strains. For ordinary welds on iron and steel plates, these strains are either negligible or easily overcome, but in the case of tin plates they are sufficient to break up the structure of the iron-tin alloy which is formed during the course of welding. It is, therefore, absolutely impossible to weld tin plates satisfactorily without first carefully removing the tin from the line of welding and its immediate vicinity in the manner indicated for the welding of galvanized plates. The instructions given for obtaining satisfactory welds on galvanized plates hold good for tin plates.—Acetylene Lighting and Welding Journal.

COMPOSITION OF ENGINE CASTINGS.

THE standard composition of British engine castings is given by Frank Foster in his paper, entitled "Essential Principles of Engine Design," read before the Manchester (England) Association of Engineers:

	Steam Cylinders	Frames	Flywheels	General
Total carbon, per cent.	2.90	3.30	3.50	3.50
Combined carbon, per cent.	0.90 to 0.95	....	0.37	....
Silicon, per cent.	1.10 to 1.30	1.60	2.00	1.70 to 2.20
Manganese, per cent.	0.60 to 0.90	0.65	0.40 to 0.50	0.30 to 0.40
Phosphorous, per cent.	0.40 to 0.60	0.50	0.90	0.40 to 1.40
Sulphur, per cent.	0.15	0.15	0.15	0.15
Transverse load, cwt.	35 to 46	34 to 38	30 to 33	29 to 32
Transverse deflection in inches	0.50	0.50	0.35 to 0.45	0.30 to 0.50
Tensile strength, tons per sq. in.	12 to 14	11 to 13	11 to 14	9 to 11

DECARBURIZATION IN SALT BATHS.

THE use of baths of molten alkaline salts for heating steel for hardening has now become general. They allow of the rapid heating of small parts of a uniform temperature and easy measurement of heat temperature. It is also generally believed that since the steel is not in contact with air during the heating superficial decarburization is avoided.

A. M. P. Portevin, in an interesting note on the subject to the last Iron and Steel Institute session, referred to experiments carried out with a steel containing 1.46 per cent. of carbon and with soft iron in a series of baths of different salts. Molten potassium chloride appreciably decarburizes steel at 900° C., and still more so as the temperature rises above this point. A mixture containing potassium chloride, sodium chloride, soda, potassium ferro-cyanide, described as Brayshaw's mixture (although Brayshaw disclaims the latter) was also shown to decarburize specimen badly.

An interesting feature was noted in the case of baths containing potassium chloride with an admixture of potassium cyanide. Samples of steel containing .78 per cent. carbon and Lancashire iron were treated simultaneously. Whilst the steel was decarburized, the iron was actually carburized from the bath. The action depends upon the cyanide admixture, the decarburizing action being almost constant, whilst beyond 25 per cent. of cyanide the carburizing action on iron decreases. The employment of cyanide of potassium requires careful investigation owing to decomposition which sets in if the bath is taken beyond a certain temperature, and owing to the possibility of introducing nitrogen into the steel.

SEMI-STEEL.

AN interesting discussion on semi-steel took place recently at the Lancashire branch of the British Foundrymen's Association. Mr. Roe, in opening the discussion, mentioned a difficulty which arose when the metal had to be carried thirty or forty yards before pouring. The difficulty consisted of hard spots at the riser end. Mr. McLain, the American expert on semi-steel, had suggested manganese as a remedy, but the reason for the addition of manganese was not clear since the latter is usually considered as a hardening element. The proportion of steel scrap to be used in the mixture depends, of course, upon the purpose for which the casting is being made. T. Craig used a mixture of 3 of steel scrap, 3 of hematite iron, and 1 of Apedale No. 4 for casting a plate shear about 1 ft. in diameter. The resulting casting contains about 1 per cent. silicon, 0.9 per cent. manganese, 0.08 per cent. sulphur, and 0.5 per cent. phosphorus, corresponding practically to a cold blast iron, but costing very much less. He had used 15 per cent. of steel in a mixture for mild chilled roll. This was a roll casting in chills, but which shows no chill when the skin is broken.

The discussion, whilst of a very interesting nature, did not elicit any definite remedy for the hard spots described by Mr. Roe. It is probable that the most efficient method of dealing with this trouble is to reduce the amount of steel scrap or increase the silicon content of the pig-iron. Another curious feature which places a tax upon the metallurgist to explain is that the use of high carbon scrap, such as old files, has a remarkable tendency to produce hard spots, whereas by using mild steel scrap, such as boiler plate punchings, the trouble is very rare indeed. This fact is all the more remarkable, since it is known that the scrap must absorb a very considerable proportion of carbon from the cupola coke, before its melting point is lowered to within the range of temperature available in a foundry cupola.

The Canadian Locomotive Company of Kingston, Ont., has received an order to build two mogul engines for a contracting firm in Northern Ontario.

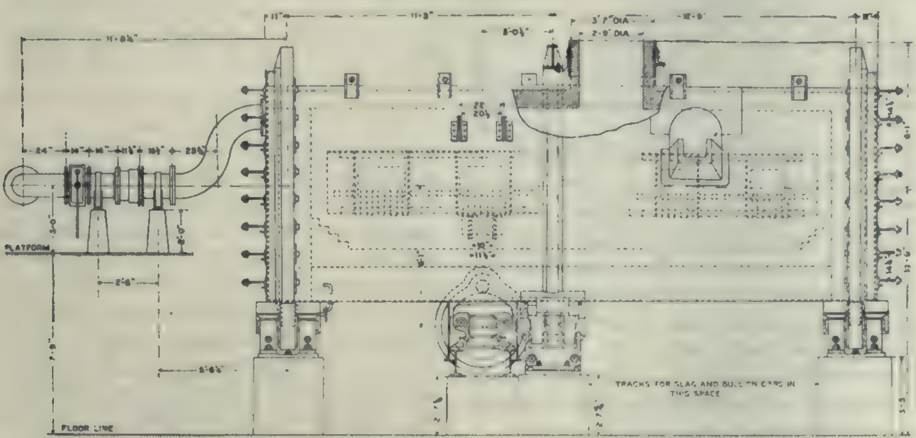
Development of Our Nickel-Copper Smelting Industry

By A. W. G. Wilson *

The accompanying article is the third of a monthly series descriptive of Canadian nickel-copper smelting plants. The European War has brought this particular industry very much into the limelight, on which account information relative thereto is of more than ordinary interest and moment. Section 3 of this description of the Mond Nickel Co. organization will deal with the Company's refining plant in Wales. Data and cuts are by courtesy of the Canadian Department of Mines and represent conditions existent in the fall of 1913.

MOND NICKEL CO.—II.

A CONTINUATION of the description of the smelting plant at Coniston, Ont., in its various features, and a description of the Wabagishik hydro-electric power plant, also the property of the company, are the substance of this second and concluding article on the Mond Nickel organization in so far as its Canadian operations are concerned.



BASIC COPPER CONVERTER, PEIRCE-SMITH TYPE, MOND NICKEL CO. VERTICAL LONGITUDINAL SECTION (A.C. CO.).

The main flue is provided with 27 hoppers, placed at 7.5 ft. centres, in sets of two, between the main bents of the supporting structural steel work. There are also four large hoppers placed between the main flue and the brick dust chamber. The bottom of the dust chamber is fitted with 6 rows of steel hoppers, 9 to a row, the distance from centre to centre being 56 in.; each hopper is provided with a circular discharge gate 13 in. in diameter, closed by a lever-operated slide. The hopper chutes beneath the dust chamber deliver to a common space so arranged that the flue dust can be run into a V-shaped auxiliary hopper of sheet steel hanging above a standard gauge track in the slag cut. Six chutes deliver from this hopper to a car placed beneath.

Blowing Equipment. — In the power building are three Connersville blowers and two Nordbergs. The blowers at the Victoria Mines plant were transferred to the new plant and one new Connersville and one Nordberg were added.

Blast Furnaces.—There are two Allis-Chalmers rectangular water-jacketed copper blast furnaces, 50 in. x 240 in., each furnace being provided with a brick-lined steel crucible and a brick top above the single tier of jackets. The height of the furnace is 32 ft. 2½ in. to the base of the hood. The hood measures 12 ft. 6 in., giving a total height of 44 ft. 8½ in. A goose-neck, 7 ft. 6 in. in diameter, connects each furnace with the main flue, and a straight stack, closed by a damper, rises 15 feet above the hood.

Each furnace is carried on structural steel columns, the jackets being hung from I beams. The crucible rests on three rows of nine supporting columns each 5 feet in height. It consists of a rectangular steel frame about 6 feet in width, 21 ft. 9 in. in length, and 25 in. in depth, made of I beams; the sole plate is of cast-iron in four sections. This crucible box is lined with chrome brick around the sides, ends, and bottom, reducing the internal width to 4 ft. 2 in.

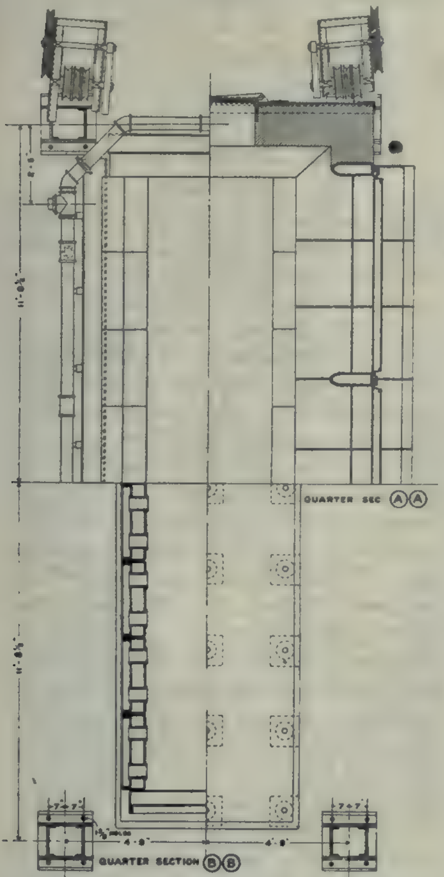
Above the crucible there is a single tier of water-jackets, eight on each side, each 8 ft. 2 in. in height. The width of the furnace is 4 ft. 2 in. at the tuyeres, and at the top of the water-jackets it is 5 ft. 9 in.

The throat of the furnace above the water-jackets is built of ordinary brick and lined with firebrick, forming a jacket 12 in. in thickness, the top being 3 ft. 7 in. below the charging floor. The space between the charging floor and the top of the brickwork is bridged by inclined apron plates. At the ends of the furnace the brickwork is carried to the top of the furnace, 8 feet above the charging floor. The charge doors along the sides of the furnace are operated by counter-weights. The settlers are about 15 feet in diameter. They are placed beside the furnaces and discharge matte and slag from opposite sides. The furnaces are placed

BLACKSMITH SHOP, MACHINE SHOP, ETC., CONISTON PLANT.

*Chief of Metal Mines Division, Ottawa.

parallel to the length of the building and may be charged from either side. Space has been provided for three, but only



COPPER BLAST FURNACE, 1912, MOND NICKEL CO. HORIZONTAL TRANSVERSE QUARTER SECTIONS (A. C. CO.).

two are being installed at the present time.

Converters.—The converters installed in the new plant are of the Pierce-Smith type of basic converter with shells 10 ft. in diameter, and 25 ft. 10 in. in length. Two have been installed in the building. The lining of each shell consists of 16 in. silica brick and 9 in. magnesite brick at the bottom, and 9 in. magnesite brick at the top. At the tuyeres, special 18-in. magnesite brick is employed. Each shell is provided with 30 tuyeres placed 14 on one side of the stack and 16 on the other, none coming directly below it.

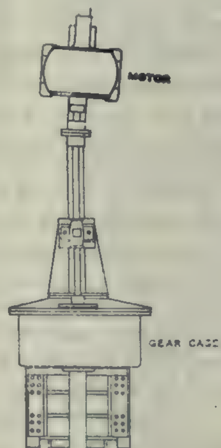
The blowing stack is 3 ft. 7 in. in diameter, but the lining reduces the free space to 2 ft. 9 in. It is placed near the median riding track, its centre being 11 ft. 2 in. from the end of the shell opposite the bustle pipe. The pouring spout is placed 7 ft. 7½ in. from the same end and about 77° of arc below the stack. The ends of the shell serve as annular tracks upon which it may be rotated, and a third riding track placed 7.5 in. to one side of the middle of the length of the shell has also been provided. The tracks rest on rollers carried on cast-iron bearing plates, bolted to a concrete foundation. The shells are turned by steel ropes pulled by a sliding gear operated by an electric motor and a worm screw, with an 8 ft. stroke. The converter floor is served by two 50-ton Whiting cranes.

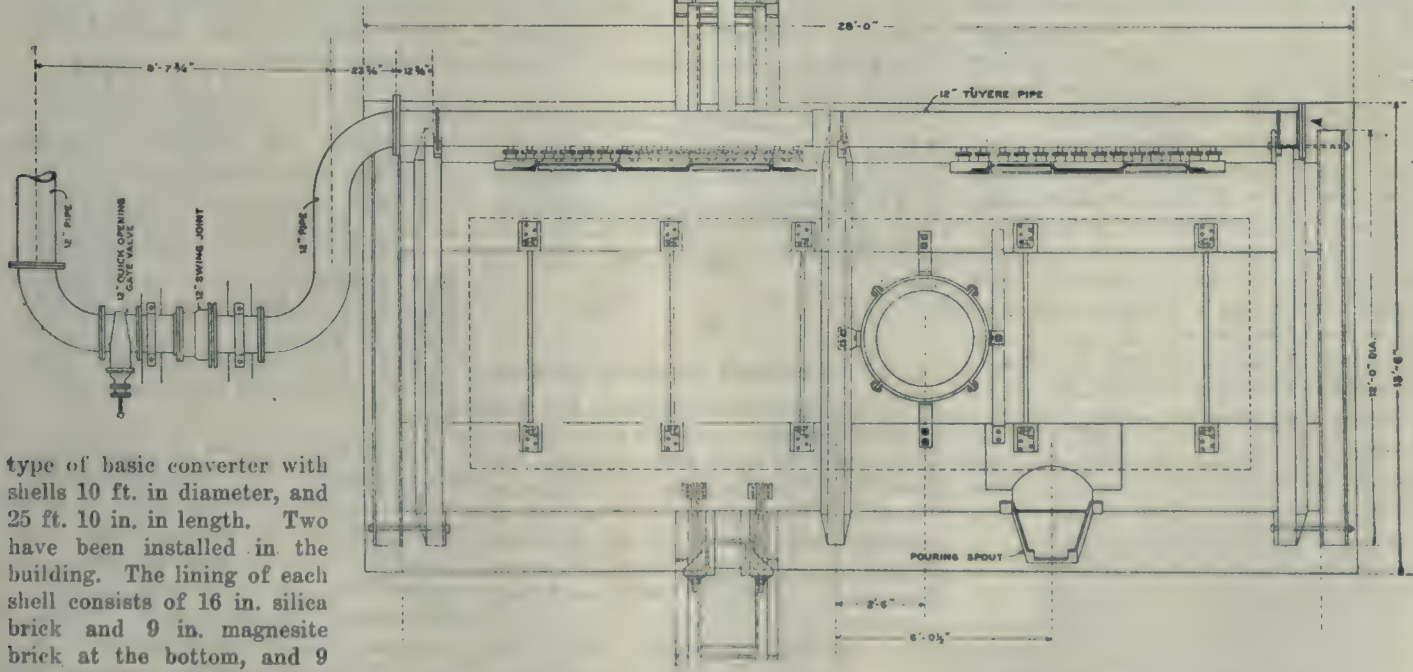
Wabagishik Power Plant.

The hydro-electric plant belonging to the company is located at Wabagishik falls, on the Vermilion river about 8.5 miles from Victoria Mines station on the Canadian Pacific Railway. The power-house is a concrete block structure, 46 ft. x 90 ft., and is equipped with an overhead travelling crane of sufficient capacity to lift the heaviest single piece of the turbine unit. The steel pipe-line leading from the dam to the power house is 450 feet in length, and 8 feet in diameter.

The main turbine is of the horizontal twin type, with a pair of cast-iron runners secured to the main shaft, all enclosed in a steel housing arranged so that the water enters parallel to the shaft, and discharges into a common draft-chest. The top part of the housing is made in removable sections to facilitate quick inspection of all internal parts. The regulating gates consist of two sets of movable guide vanes, operated between two rings moved by short links, and regulating rings that are connected to the regulating shafts by rods and levers. The machine is governed by an hydraulic cylinder with piston connected by rods to the gates and operated by a geared pump and pressure cylinder. This pressure cylinder is provided with a fly-ball governor, driven by belt from the main shaft, by which oil, under pressure, is admitted to either end of the oil cylinders, as required.

The turbine is designed to operate with 500 cubic feet of water per second under a 50 ft. head, when running 300 revolutions per minute at a power factor of 80 per cent. It is direct-connected to a 1,200 k.w. 60-cycle, 3-phase, 2.200-volt, alternating current generator. This machine, when running under load, generates from 800 to 1,300 k.w., the latter be-





BASIC COPPER CONVERTER, PEIRCE-SMITH TYPE, MOND NICKEL CO. HORIZONTAL LONGITUDINAL SECTION. (A. C. CO.).

ing the peak load when the mine hoist is suddenly thrown into action.

The exciter unit consists of one single horizontal-shaft turbine, mounted in a cast-iron casing, with regulating gate made up of guide vanes pivoted on pins between two heads, and operated by means of a split regulating ring on the front head, connected by links to the governor. The generator is direct connected to the shaft, and is a 60-k.w., 120-volt machine. It is designed to operate on 27 cubic feet of water per second, at 50 ft. head, when running 875 r.p.m.

The switchboard apparatus at this power plant consists of one panel for control of the exciter, one panel for control of the generator, and one line panel provided with 16,500 volt lightning arrester and accessories. The generator voltage is 2,200, and this is stepped up to 16,500 volts for transmission over the power lines. The transformer equipment at the power house consists of one bank of transformers (three) of 800 k.w. capacity each. Power is transmitted over a line of No. 6 copper wire.

The smelter sub-station was equipped with three 350 k.w. oil-insulated, water-cooled transformers, which stepped the power down from 15,000 to 600 volts.

The Victoria mine sub-station is equipped with three 200 k.w. transformers, 15,000 to 600 volts.

NICKEL REFINING IN CANADA.

IN view of the fact that in another section of this issue there appears the second and concluding article on the Mond Nickel Co. plant at Coniston, Ont., and also that in next week's issue we will deal with the same concern's refining plant in Wales, the following extract from a contribution to the Toronto Globe will be found not only interesting but to some extent supplementary.

Much, says the author of the article, has been written of late on the nickel question, some of the statements made being fairly truthful, but a large proportion betraying either gross ignorance or a suspicious bias in favor of interested parties, yet it is doubtful if there is a conscientious metallurgist to-day that can advance any sound objection to the refining of nickel in Canada.

The Lack of Raw Materials.

The lack of some necessary raw materials has been cited as an insuperable obstacle, but what these are is a mystery. If salt cake or any sodium compound be one of them, has not Canada unlimited quantities of common salt within her territory, as well as factories turning out alkaline products of various kinds? The installation of a nickel-refining plant would be a powerful stimulant to other industries that produce the materials it requires and, if the excess of by-products be considered a serious matter, let us remember that Canada is growing and developing every day.

Within the next twelve months there may be a market for double and treble the output of some of our factories, for one new industry begets many others. Hydrochloric acid has been mentioned as a by-product hard to dispose of in this country, and it may be advisable to point out here that the Hybinette refining process for nickel requires this article in large quantities.

Does any reasonable person fear that such a profitable business as the production of nickel will collapse if an export duty is placed on the matte or ore? It is far more probable that Canada will see within six months of the date of the order the most intensive job of plant construction ever performed in this country. There need be no fear of a monopoly, and by insisting on the refining of our nickel within the Empire we shall escape from the pitfalls of contraband law, a harassing event in war times, and such serious and complete financial disaster as has lately befallen the Australian zinc industry.

There is a strong and rapidly growing feeling prevailing throughout the Empire that we should no longer permit other nations to control the markets of products derived from the Empire's natural resources, and this is a matter that the next Imperial Conference should take cognizance of, formulating some plan that will be fair and satisfactory to all the Dominions and colonies. "Made-in-Canada" is a good cry, but "Empire-made" has a broader and more significant meaning, releasing us all as it will from the domination of the Guggenheims, Hirchs, Sondheimers and other foreign exploiters.

The writer himself has unlimited confidence in the future of Canada, with her almost illimitable prospects, and faith and co-operation are all we require to insure us that prominence in the commercial world to which we are justly entitled.

HARD CASTINGS REMEDY QUERY.

WE have a home-made cupola, the shell of which belonged to an old steam boiler. The cupola is lined with firebrick, and has an inside diameter of 26 inches. There are four tuyeres of 4 in. x 4 in. section, and the blast is delivered through a 7-in. pipe from a Boston Blower Co. exhauster. We use Albany molding sand mixed with our own yellow sand, the latter of which old molders claim to be all right when so employed. We can melt any amount of iron, but our castings are very hard, so much so that considerable trouble is experienced when they come to be machined. Suggestions as to a remedy or remedies for this hardness are invited from readers of Canadian Machinery.—Allie Bros., Maniwaki.

RUNNING COSTS OF MOTOR VEHICLES

IN the course of a paper on "Running Costs of Motor Vehicles," read before the Society of Engineers (Incorporated), on March 1, R. W. A. Brewer, the author stated that the problem before the automobile engineer was to transport persons and goods in a minimum of time and at a minimum cost. The second consideration was, perhaps, the more important, and could be profitably discussed from an engineering standpoint. The main heads under which expenses might be classified were (i) fuel cost and consumption, (ii) lubrication systems and consumption of fuel (iii) wear and maintenance, (iv) tires.

As regards fuel cost, it could not be said that a powerful engine was proportionately a greater fuel consumer than a similar one of less power, and the author discussed the factors producting economy in the use of fuel. The question of efficient lubrication was of the highest importance, but little progress had yet been made and further experiments were necessary. Piston friction also required more investigation, the most suitable form and material and the appropriate number of rings for a given type of car being yet undecided; attention was also directed to the problem of piston clearance. In valve mechanism there was little room for improvement, but the transmission losses had not yet been reduced to a minimum.

Gas friction caused loss due to the reduction of the volumetric efficiency of the engine, and efficient carburation played an important part in reducing loss from this cause, while changes of direction of flow should be made as easy as possible. At all diversions of the flow path, a sufficiently high wall temperature must be provided to prevent precipitation. It was not so much the quantity of heat as its application at the correct points that was of the highest importance.

The author criticized the usual method of conducting fuel consumption tests, and indicated the importance of using an accelerometer when making such tests. The variation of the power required to drive a car was due largely to wind and rolling resistances. Total car resistance was also influenced by the balance of the wheels, engine parts and propeller shafts.

Machining Shrapnel Shell Parts, and the Tools Employed

By F. H. Mayoh

Just as there is a wide distribution of orders for the machining of 18-pounder shrapnel shell parts, in like manner will there be more or less diversity in method and procedure adopted relative to their quality and quantity output as finished products. A thoroughly practical demonstration of how to achieve the desired end profitably is given in accompanying article.

THE component parts of shrapnel shells are of course no less important than the case or body and are usually manufactured on a commercial

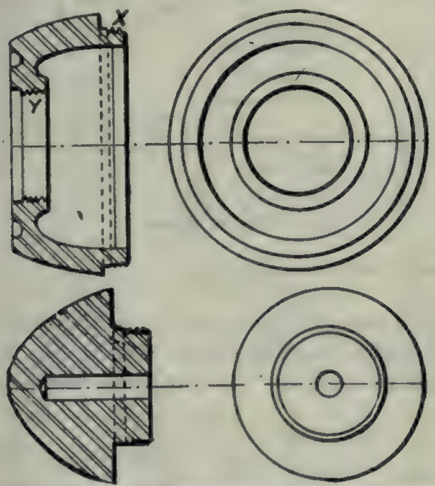


FIG. 1. UPPER—SHRAPNEL SHELL HEAD "A." LOWER—SHRAPNEL SHELL CAP "B."

basis by the use of special tools which make for rapid production.

The first of these component parts to be featured is known as the shrapnel shell head, a detail being shown at A, Fig. 1. This head has two threads cut on it, one outside X, where it is screwed into the case, and one internal thread Y, where the cap part of the shell is held. It is with this portion of the shell that the timing is done, and the operations when made from forged blanks as is usually the case unless the shells are small, consist of boring the threaded hole, forming the inside, turning the threaded end, facing the end, tapping the hole, threading the outside end, and forming the outside.

Handling these heads on a turret lathe of the automatic type, the first operation is shown by Fig. 2, with the tool set up which is used in this connection. Referring to the illustration, the piece is gripped over the outside at the large end by means of special jaws A in a three-jaw chuck, these jaws being bored out to conform to the shape of the work and scored or checked to enable them to secure a good grip.

In the hole of the first turret face, a drill B, is placed which is of the three or four lip type for opening up the hole. On the cross slide is mounted a tool C, which rough shapes the outside of the head and rough faces the end. The turret now indexes, and the hole to be threaded is bored with blade D, and counterbored with blade E, while a blade F, cuts a recess or groove in end. All of these tools are held in a piloted boring bar G, fixed in the hole of the turret. The tool H, on rear cross slide block finish faces the end. On the next

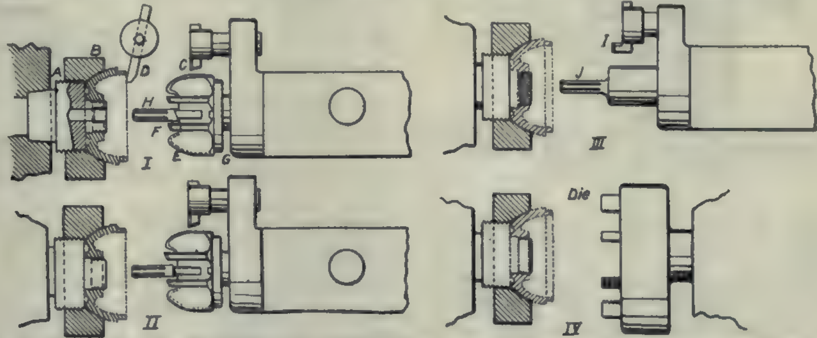


FIG. 3. SECOND OPERATION ON SHRAPNEL SHELL HEADS FROM FORGED BLANKS.

indexing of the turret, the hole is tapped with tap in turret hole I. This completes the first operation on the head, and it will be noticed that the fourth turret face is left blank.

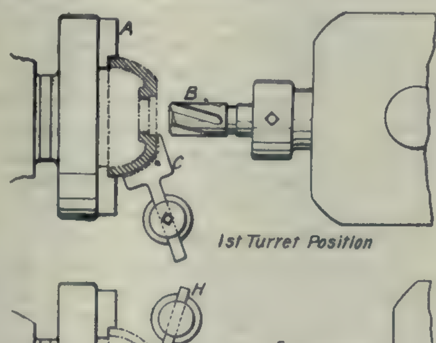


FIG. 2. FIRST OPERATION ON SHRAPNEL SHELL HEADS FROM FORGED BLANKS.

It quite often happens that when an extra turret face is available, what is known as a conveyor is placed in it, the latter being simply a sleeve held in the turret hole which is bored out to take the work being handled. As the turret is going through the cycle of cuts, the operator places the work in this sleeve and it is thus conveyed to the chuck at the proper time. These conveyors are employed on various classes of work, being varied to meet conditions. They are mostly used with a lever chuck, a compressed air collet or device making the machine almost completely automatic. Conveyors answer the same purpose as a hopper or other automatic feed on a screw machine except that owing to the nature of the work, but one piece is placed in the holder at a time and this is done when it does not interfere with the operation of the machine.

The next step is to finish the inside of the shrapnel shell head, turn and thread the outside, face short hub and face end. This is acomplished by means of the tool set up shown by Fig. 3, and is followed by a third operation, Fig. 4, at which time the stock left around the outside curve is turned off with a single point tool.

Referring to Fig. 3, the head previously tapped and counterbored is placed on a threaded arbor A, and run up to a shoulder with the counterbored end fitting the arbor to centralize the work. In this position the collar B is screwed back against the work, in the manner shown to brace it. We are now ready to take the cuts and proceed by first turret face, rough turn thread C, rough face end D, rough form inside with formed mill E, and rough face short hub with blade F in bar G, which holds formed mill and in turn is held by the turret. The turret now indexes, and we finish the same places that we previously roughed by similar tools held in similar fashion. It will be noticed in this connection that the bar which holds the

formed mill has a pilot H, which is a running fit in a bushing in the arbor, and holds the turret of the lathe rigid with the head stock, ensuring more accurate work. On the next turret face is held a blade I, for boring out the hole at the large end for a short distance, and this

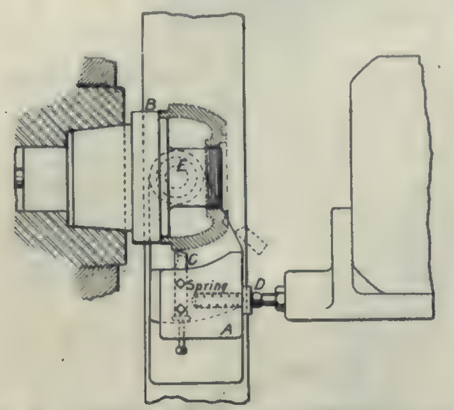


FIG. 4. THIRD AND FINAL OPERATION ON SHRAPNEL SHELL HEADS FROM FORGED BLANKS.

is known as size boring. A bar J, is also placed in the turret hole at this cut for the piloting purposes, outlined above. Cutting the thread completes the operation and is done with a die on the fourth turret face.

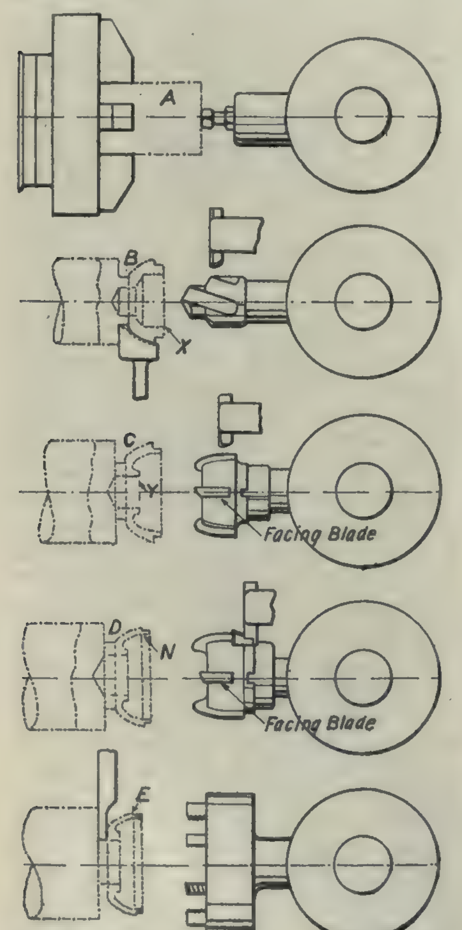


FIG. 5. FIRST OPERATION ON SHRAPNEL SHELL HEADS MADE FROM THE BAR.

By means of the swing tool A, Fig. 4, the third and final operation on these heads is performed in the following manner. The head is placed on an arbor B, fitting at the size bored end, and is screwed up by means of the thread at the small end of the head. When in position, the cross slide has been locked so that it cannot move either in or out, and the blade C is in the position shown by the dotted lines at start of cut. As the turret comes forward, a screw D, in a bracket bolted to the turret pushes the

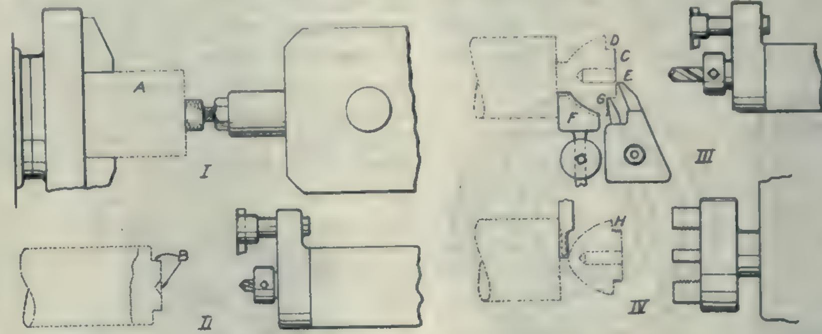


FIG. 6. FIRST OPERATION ON SHRAPNEL SHELL CAP.

upper part of the cross slide block, thus causing it to pivot on the stud E, and turn the arc. As the turret returns, a spring in the cross slide block forces the swing tool back to its original position at start of cut. In this operation, it is unnecessary to revolve the turret, as but one face is used (the one for pushing), so the turret is locked in position on the turret slide.

Shell Heads From Bar.

The manufacture of shrapnel shell heads from the bar is usually accomplished in two operations, on either a screw machine or turret lathe when the size is small enough to warrant this method, although there is no saving of time owing to the amount of metal it is necessary to remove, and an outline of these operations is given below.

The stock is fed against a stop and gripped by an automatic lever chuck as shown by A, Fig. 5. The bulk of the stock is removed or the piece roughed cut by drilling the two holes, turning the end to be threaded and starting to cut off with a wide cutter which cuts out the blank to approximate shape, these cuts leaving the work supported in the chuck as shown at B, Fig. 5. At the same time that this is being done, the end X is faced by a blade on the cross slide. The next batch of tools on the third turret face and in the turret hole leave the work as shown at C, Fig. 5. The operations are rough form inside with formed mill, rough face short hub Y. The turret indexes, and the next batch of tools finish out inside, finish face short hub, finish turn for thread and size bore end Z, as shown at D. On the next face the thread is cut and piece cut off as shown at E, Fig. 5.

At the second tool set up or operation, the shrapnel shell head is reversed and placed on an arbor and has the hole to be tapped, bored and counterbored, the groove in the end cut, the end faced. The outside arc is then turned with tools similar to those for use on forged blanks thus completing the piece in two settings.

Shell Cap.

It is customary to think of a shell as having a point on it, and, in the case of shrapnel, this point takes the form of a cap which is shown as B in Fig. 1. The methods of manufacturing this cap

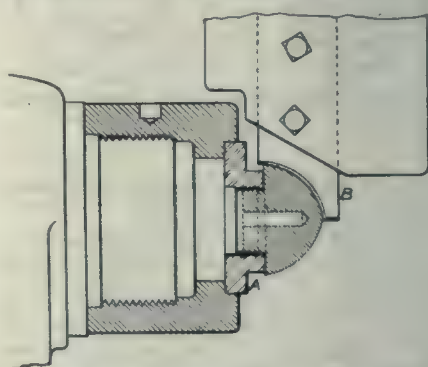


FIG. 7. SECOND OPERATION ON SHRAPNEL SHELL CAP.

is shown by Figs. 6 and 7, first and second operation respectively, these caps being usually made from the bar.

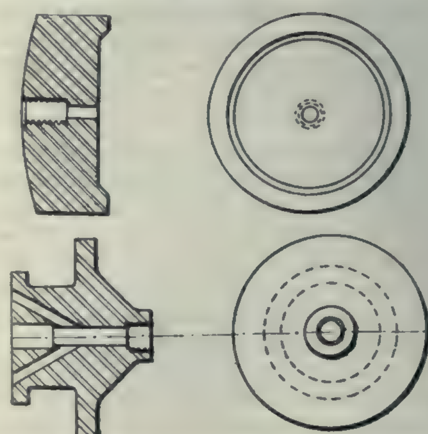
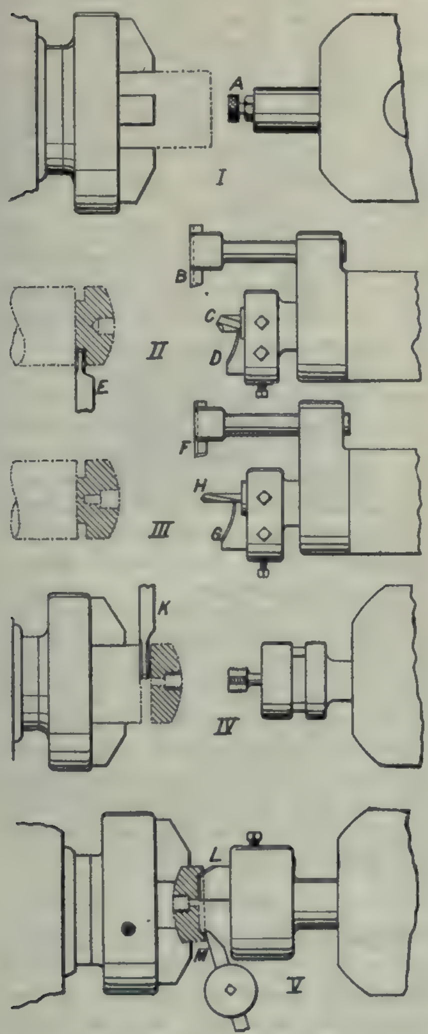


FIG. 8. UPPER—DISC "A" WHICH GOES NEAR POWDER POCKET. LOWER—PIECE "B" TO BE MADE FROM BAR AND DRILLED.

The first operation consists of feeding the stock against a stop on the first tur-

ret face A, Fig. 6, rough turning the place to be threaded, and spotting the hole to be drilled, B, with the second turret face; drilling the hole C, finish turning the place to be threaded D, and facing the end E, with the third turret



First T.F., Second Operation.

FIG. 9. METHOD OF MACHINING PART "A," FIG. 8.

face and the cross slide in the manner shown. At the same time, the formed blade F, roughs out the form of the cap, and a blade G, faces down the shoulder. The final cuts in this operation are cutting the thread H, with a die and cutting off the partly completed cap. By referring to Fig. 7, the final operations of screwing the cap into an arbor A, and,

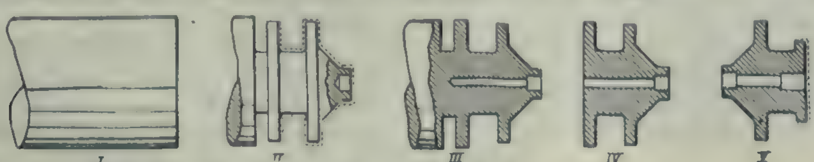


FIG. 10. METHOD OF MACHINING PART "B," FIG. 8.

I.—Blank at start of operation. II.—"A" after first cuts are taken. III.—"A" after finishing cuts are taken. IV.—Piece "C" tapped and cut off. V.—Piece reversed and final cuts taken.

with a swing tool on the cross slide or a formed block B, the shape of the outside is finished to form.

Near the closed end of a shrapnel shell next to the pocket where the powder is placed for exploding the shell a disc is placed which holds the powder in place, and this is channeled out at the back and has an arc formed at the front to improve the action of the firing of the shells.

This piece is shown at A, Fig. 8, and is made from the bar in the following manner. The working is very simple but requires two operations to complete as follows:—Feed the stock against stop A, first turret face; rough turn outside B, drill hole to be tapped C, rough curve end D, and start to cut off E, all of the latter being carried on the second turret face and cross slide. On the third turret face, tools similar to the foregoing are used to finish turn the outside F, finish the curve G, and for drilling the small hole a drill H, is used which follows the point left by the larger drill preceding it. In the fourth turret hole a tap J, is placed for threading the large hole, while the partly finished blank is cut off by blade K. Reversing the piece now cut off, we grip it in a true running soft jaw chuck that has been bored out to receive the blank, form the recess L, and face end M, both operations being illustrated in Fig. 9.

At B, Fig. 8, another piece made from the bar is shown and as the general method of making this piece is along the same lines as those for making the previous pieces, no attempt will be made to give the tool details. The operations are feed to stop, drill large hole for thread, rough turn, hog out groove, rough form at end and start to cut off, leaving work as shown at A, Fig. 10. Next, drill small hole, face end and finish outside as mentioned above, leaving piece as at B, Fig. 10. Following this we tap C and then reverse the pieces to perform the next operation by gripping in a soft-jawed true-running chuck on the finished periphery while the end is faced, the small hole counter-bored and the outside, X, rough and finish turned.

In this piece it will be noticed that there are two small angular holes which must be drilled, and this is accomplished in the jig, Fig. 11, the work being slipped into a hole, A, in this jig and clamped by means of the swing-piece and screw, B. This holds the work, and the angular location is obtained by flatting off the sides, C, and having pilot bushing, D, to guide the drills into the correct position.

The other parts of the shrapnel shell are easily made, the balls being made in

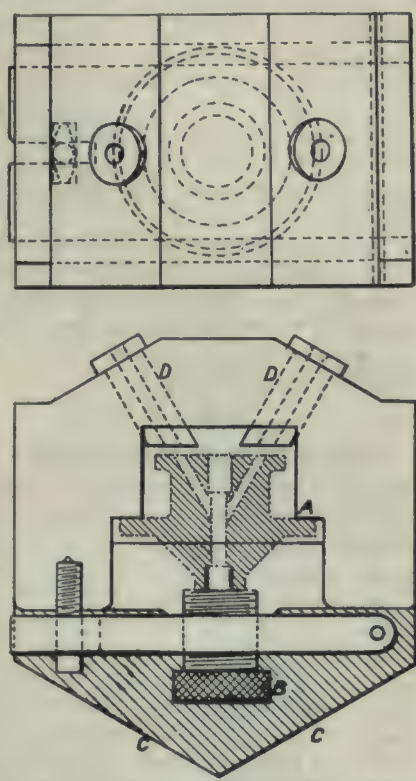


FIG. 11. DRILL JIG FOR TWO SMALL HOLES, PIECE "B," FIG. 8.

large quantities by special apparatus and handled by the bushel.

The tube is a screw machine product

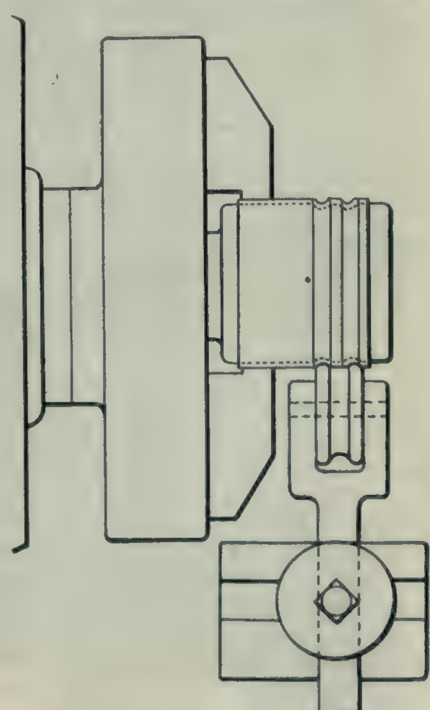


FIG. 12. METHOD OF SPINNING GROOVES ON SLEEVE.

made from tubing which only needs to be threaded, cut off, reversed and the opposite end threaded, or, if a double

head threading machine be available, they may be cut off, and then both ends threaded at the same time. The other small piece shaped like a cylinder is also a screw machine product and is made from the bar without turning. It has the ends rounded and is cut off.

The brass sleeve or hollow cylinder is made of tubing, cut off and placed on an arbor or held in the spindle of a lathe. It is gripped on the arbor by a soft-jawed chuck, and has the grooves spun around it.

The copper ring is usually made from tubing, bored and reamed. The outside is turned, the angles formed at the end and cut off, the whole being accomplished in one operation on a turret lathe or screw machine.

GOVERNMENT FACTORIES.

BECAUSE scandals are reputed to have occurred in the fitting out of the first Canadian contingent with boots, blankets and what not, some of the advocates of government ownership of everything recommend, says the Montreal Gazette in an editorial, the establishment of Government factories for the production of all materials required by the public departments, from clothing for the militia to cars and rails for the Intercolonial; the theory being that in this way the country could save money and corruption be banished.

These persons have usually a great respect for the memory of Cobden, but have evidently not read the last speech he made in the British House of Commons, which was a violent yet seemingly well-founded attack on government factories. It is summed up in a book, "Cobden and Modern Political Opinions," written by his relative, the late Professor Thorold Rogers, an economist of repute, who adds some interesting remarks of his own.

Government Factory Statistics.

A government factory can usually show that it is making goods cheaply because it seldom, if ever, takes account in its balance sheet of the public money invested in buildings and machinery, its estimate of the cost of production being based merely on the amount paid for labor and raw materials, the overhead charges being ignored. It was found in England, too, that the Government factory was not stimulative to invention and improvement. A private factory is quick to adopt new machines, and try new processes, strives to obtain the most skilful workmen, is economical and thrifty; in short, is conducted in a business-like manner.

On the other hand, the government workshops had no motive to improve for even if operated with stark inefficiency they received their annual appropriation regularly and carried on in the old groove, "building wooden ships long after wooden ships were exploded and producing munitions of war after patterns which the progress of science had antiquated long before." As there was no master's eye, the waste was prodigious, in some cases ludicrous.

Valuable materials were condemned and sold as old stores, the Government not infrequently buying them back at a greatly enhanced price. Certain projectors who had inventions or articles to sell dominated the factories while worthier ones were as good as excluded; and that wholesale grafting prevailed was notorious. So many people were interested in the maintenance of these abuses that when the cabinet of Lord Derby and Mr. Disraeli began the work of reform by closing the public workshops on the Thames there was a roar of protest.

We may take it for granted that much the same story would have to be told of public workshops in Canada. If any private contractor has been guilty of supplying defective or worthless goods to the soldiers, let him be punished to the full extent of the law; but we had better think twice before committing the Government to the business of manufacturing, for which it is not fitted.

HIGH PRODUCTION DRILL PRESS.

THE College of Engineering of the University of Illinois has recently installed a high production drill press in its machine shop. This press is to be used in a series of tests on drilling in metals. The machine is of heavy construction, weighing 2,600 pounds, and has sufficient power to drive drills of high speed steel to their ultimate capacity.

At the highest rate of production, the machine forces drills through cast iron at the rate of 53 inches per minute, this being from three to five times the rate for ordinary drill presses, and almost equal to the rate of drilling wood a few years ago. The machine is of the all-geared type, no belts being used for power drive for any part of the machine. This geared drive eliminates the chance of slippage between motor and drill. All gears run in a bath of oil, and the machine is equipped with a circulating oil pump. The drive is by a 7½ horsepower motor.

A double wheel drill grinding machine has also been added to the equipment in the machine shop. This grinder has a wide range of adjustments, and makes possible the systematizing of drill grinding. With this grinder it will be possible to carry still further the noteworthy work of the Illinois shops in devising and using special tool charpening appliances.

CALORISING.

A NEW process, called "calorising," or placing a protective coating on iron and steel and other metals, especially for use under high temperature conditions, has been worked out in the research laboratory of the General Electric Co., New York. According to the Iron and Coal Trades Review, "calorising," which is the discovery of T. Van Aller, consists in heating metals in revolving drums with mixtures containing, among other things, finely divided aluminum, so that a surface alloy containing aluminum is produced.

In the case of copper, this alloy is of the nature of an aluminum bronze, but richer in aluminum than the ordinary alloy of that name and more resistant to heat, so that copper thus treated is protected, up to the melting period of the alloy, from the scaling which occurs when untreated copper is heated above 300 deg. Cent. The same general result is obtained in the case of iron and steel.

Some use was made of this process for treating copper soldering irons and iron-resistance wires for heating devices. Pieces which, because of their shape or size, are not adapted for tumbling, may be calorised by packing them in, or painting them with, a suitable mixture and heating them. There are many places where it is desirable to use iron vessels or apparatus at temperatures above red heat, and at such temperatures ordinary iron rapidly oxidises and scales away. After iron is calorised, the effect of heating is slight.

February Fire Loss.—The losses by fire in the United States and Canada during the month of February, as compiled by the New York Journal of Commerce and Commercial Bulletin, aggregated $13,081,250, as compared with $20,060,600 in January, and $21,744,200 in February, 1914. The losses for the first two months of this year reached a total of $33,141,850, as compared with $44,948,900 for the same time in 1914. The following table gives a comparison of the losses for the first two months of this year with those of 1914 and 1913:

	1913	1914	1915
January—	$20,193,250	$23,204,700	$20,060,600
February—	22,084,600	21,744,200	13,081,250
Total 2 months—	$42,277,850	$44,948,900	$33,141,850

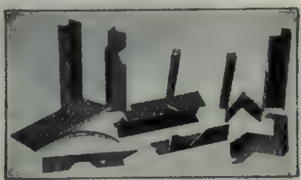
F. H. Hopkins & Co., railway and contractors' supplies, Montreal, have been appointed sole Canadian selling agents for the contractors' hoisting engines, etc., built by the Napanee Iron Works. Napanee, Ont.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

COMBINATION PUNCHING AND SHEARING MACHINE.

TO meet the demand for a universal combination machine among ornamental iron shops, as well as structural and car shops, that will handle punching, shearing and notching work without the necessity of interchanging attachments or of having to maintain a number of single machines for each operation, the Ryerson quintuple machine has been designed. It embodies five metal-working machines in one, handling the punching, shearing, coping and notching work on plates, bars, angles, tees, beams and channels, without the necessity of interchanging attachments for the various operations. Punch as well as bar cutter and splitting shear may be operated independently by automatic clutches which can be thrown in either by hand or foot. Work as illustrated can be done on this machine without change of tools, and cuts made are claimed to be perfect.



WORK SAMPLES.

Plate Shear.—The frame of the machine consists of a solid steel offset shear body, which permits the cutting of plates of any width or length. A hold-down, which can be adjusted vertically and horizontally, is provided with the splitting shear.

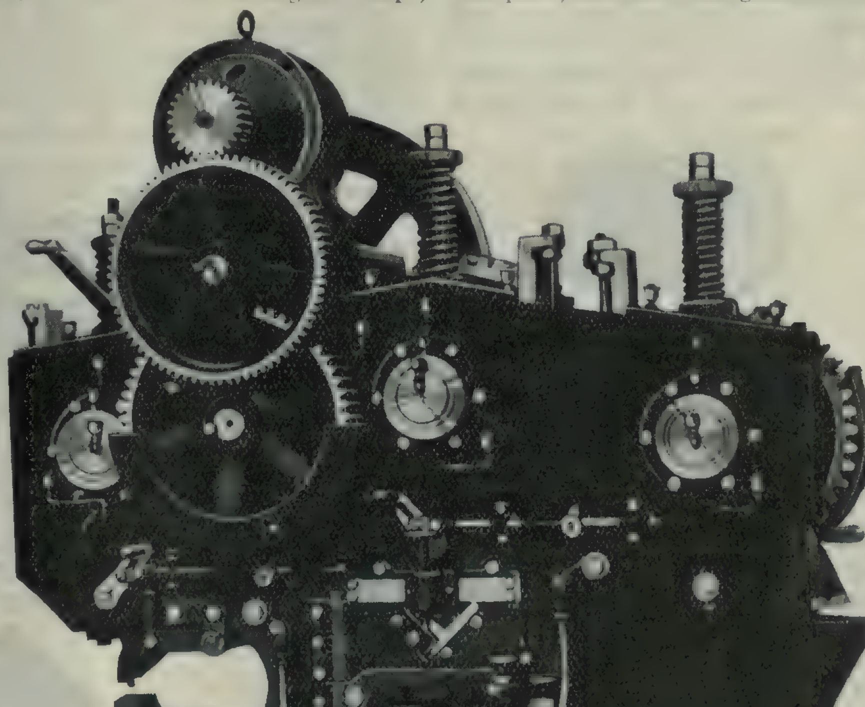
Bar and Angle Cutter.—By means of an improved arrangement of bar-cutting device, angles, tees, round and square bars can be cut without change of shear blades. The upper blade for shearing angles and tee bars is of right angle shape (no point or flat angle), which produces a clean cut without bending even the smallest and lightest sections. The shear blades are fastened to the slide in a simple manner, and are made in four pieces instead of one. Stationary blades are mounted in a hinged steel frame. This enables easy removal and grinding of any part of the shearing blades. The advantage of this construction as compared with the one-piece shear blade can be readily appreciated. Adjustable hold-downs permit the cutting of various material to a perfect right angle, and a special attachment furnished allows the cutting of angles in mitre up to 45 degrees.

Punching Machine.—All punches are equipped with standard architectural jaw, permitting the punching of I beams, channels and sections alike, in flange and web. A patented centering device is furnished with each machine, allowing the centering of punch to the full length of stroke of plunger. Universal hold-down takes care of stripping any material to be punched.

Coping and Notching Machine.—The sliding head of the splitting shear is provided with an extension to receive the die block for coping and notching work. This die block is of rectangular shape, permitting not only the standard coping of light I beams and channels, but also notching of angles, tees, Z bars and other material used in connection with stair, fire escape and ornamental work, etc.

General.—These combination machines are equipped with steel gears, cut teeth throughout, and can be furnished either for belt or motor drive. If direct electric drive is required, the machine is furnished with motor bracket, gear and rawhide pinion, and the motor is mounted on top of machine. With machine arranged for belt drive, tight and loose pulley and belt shifter, are supplied.

The sliding heads are made of crucible steel, finished all over and adjustable by means of bronze gibs. All plungers are counter-balanced by heavy coil springs. Shafts and eccentrics are forged out of one piece, machined and ground to size. Long bearings are provided for each shaft, bronze bushed, and ample provision is made for sufficient lubrication. All gears are well covered with cast



QUINTUPLE COMBINATION PUNCHING AND SHEARING MACHINE.

guards, so as to insure safety, and to conform to laws for the protection of workmen.

This quintuple combined punching and shearing machine is especially adapted for such shops as have not sufficient work to merit the extra expense of separate tools for the several operations.

These machines are made by Joseph T. Ryerson & Son, Chicago, Illinois, in four sizes, embracing in their plate shear feature thickness of plate from ⅜ in. to 1 in. The approximate weights vary from 3,000 lbs. in the smallest size to 25,000 lbs. in the largest, and each different size can be furnished in eight different combinations to fill special requirements.

LINE OF TOOL HOLDERS

THE line of tool holders described and illustrated herewith are manufactured by J. H. Williams & Co., Brooklyn, N.Y., and embrace those for turning, boring, planing, cutting-off and side, knurling and threading operations.

We understand that unusual precaution has accompanied the development

FIG. 1. FORMS OF LOCKING CAMS.

of this line of holders. Every detail has been tested and given closest possible attention. Materials best adapted to each of its parts have had every consideration and variety of test, and the design, with the thought of its fullest utility and non-obstructive character, has had abundant and purposeful care.

The holders or shanks, are all drop-forged from a strong, tough grade of carefully-selected steel, are submitted to a special heat-treatment or refining process, after forging, which develops resistance to wear, and gives the great strength necessary to overcome the pushing-thrust imposed upon the cutters. The cutter-holding channel provides an unusually strong seat for the cutter and great resisting qualities for the work imposed upon this portion of holder—a fundamental requirement in tool-holder efficiency.

The cam-fastening which features the turning, cutting-off and side and threading-tool holders is furnished from hardened and tempered crucible tool steel in either headless or hex head form. This simple and most efficient fastening largely eliminates trouble. It is practically indestructible, and removes thereby the repair and replacement necessities so common.

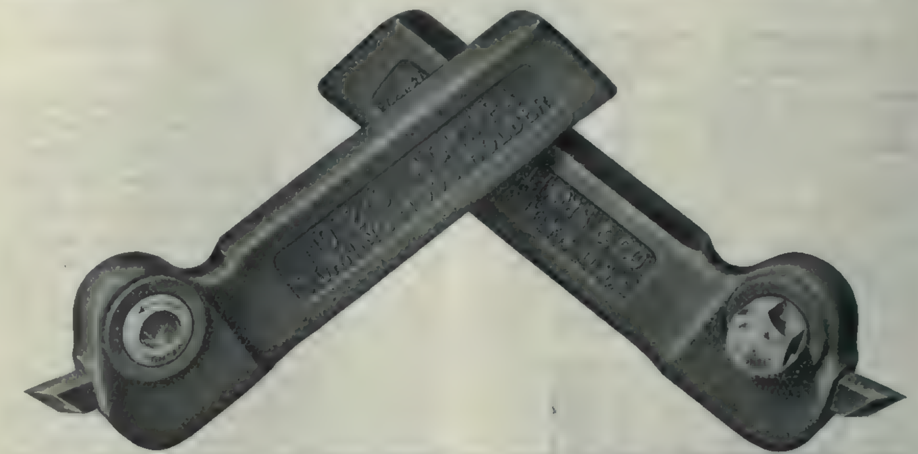


FIG. 2. TURNING TOOL HOLDERS WITH STRAIGHT SHANKS, SHOWING THE TWO TYPES OF CAMS.

The bar cutters are made from self-hardening and high speed steels of selected grade and are cut to the "diamond point" form or bevel. They thus provide for most common requirements with the minimum of grinding for either right or left-hand usage, as well as the full extent of economical service that may be demanded of a superior toolholder. Those who have had experience in the use of tool-holders in which the cutter is held in place by a set-screw know that trouble is frequently due to the breaking of the screw.

When this happens, it is a difficult matter to remove the broken part of the screw from the holder, because the screw is bearing against the cutter and the back pressure locks it in the thread. An investigation of workmen's time cards in many shops has shown that it is not an uncommon occurrence for a man to

FIG. 3. CUT-OFF AND SIDE TOOL HOLDERS WITH RIGHT AND LEFT-HAND OFFSET SHANKS.

spend more time on the removal of a broken set-screw than the entire tool-holder is worth. Furthermore, it is often found necessary to anneal the screw in order to drill it out, and when this is done the metal in the tool-holder is likely to be damaged.

Locking Cams.

With the view to overcoming the difficulties resulting from the use of set-screws, a carefully designed form of locking cam made of hardened and tempered tool steel has been substituted. These locking cams have a very gradual rise so that an extremely powerful grip is obtained through the application of a moderate pressure on the wrench with which the cam is turned. These cams are made in two forms as shown in Fig. 1, one of which is provided with a hexagonal head so that it may be turned with the special wrench provided for that purpose or with any other wrench that will fit. The second form of cam has a hexagonal socket and is turned by the same kind of key wrench that is used on the well-known hollow safety set-screws. The cams with the hexagonal head are of the standard form, but the cam with the socket is provided for cases where there is not sufficient clearance to admit the head of the cam, an example being the turning of small crank-pins and facing the cheeks of the cranks.

The two forms of cams are interchangeable in the same holder. Only about 1-12 of a turn is necessary to

tighten the cutter in the holder or release it, so it will be evident that the operation is quite rapid. Full freedom of operation is obtained without removing the holder from the toolpost. With the idea of determining the relative strength of the grip obtained with the Williams cam fastening and with the commonly used set-screw, tests were conducted by mounting tool-holders provided with ¼-inch cutters held by the two forms of fastenings in a fixture mounted on a Riehle testing machine and applying pressure to the point of the cutter. It was found that the cutter held by a set-screw could be moved by the application of a pressure of 2,400 pounds, while the cutter held by a cam required the application of 4,200 pounds pressure to move it.

Turning Tool Holders.

Fig. 2 shows the Williams turning tools provided with the two forms of cams and with straight shank holders. Turning tools of this type are also made with both right-hand and left-hand offset shanks. The holders with straight shanks are made in seven different sizes

FIG. 4. BORING TOOL HOLDER SHOWING CUTTER IN STRAIGHT AND ANGULAR POSITIONS.

with capacities for square cutters ranging from ¼ to ¾ inch in size; and the holders with off-set shanks are made in six different sizes with capacities for square cutters from ¼ to ⅝ inch.

Cutting-off and Side Tool Holders.

Fig. 3 shows a combination tool-holder for cutting-off tools and side-tools. It will be seen that the broad edge of both the cut-off and the side-tool cutters are at the top. In the case of the cut-off tool this is necessary to provide the required clearance; and in both cases, having the broad edge of the cutter at the top provides more metal behind the cutting point for the purpose of conducting away the heat generated by the cut as rapidly as possible to avoid damaging the cutter. These tool-holders are made with straight shanks with the cutter on the right-hand side, and with right- and left-hand off-set shanks. Both styles of holders are made in five different sizes with capacities for cut-off tools ranging from 3-32 by ⅝ inch up to 3-16 by 1⅛ inch in size; and for side-tools ranging from 5-32 by ⅝ inch up to ⅜ by 1⅛ inch.

Boring Tool Holders.

The distinctive features of the new Williams boring-tool holder are that the same holder can be used for all sizes of boring-bars which come within its range without requiring the use of bushings or shims; and that the cutter can be supported in the sleeve bar in a straight or angular position without requiring the use of more than one cap. Reference to Fig. 4 will make these features clear. The shank is provided with a shoulder in which there is a groove which receives the boring-bar, the bar being held in place by a cap and two screws. The larger sizes of bars are held as shown in the illustration, but when the bar is so small that the cap contacts with the holder, the cap must be removed and replaced in the reverse position so that the slot in the top engages the bar.

Fig. 4 shows clearly the way in which the cutter may be held in the bar in either a straight position or at an angle, while reference to the illustration will also show that there is a tapped hole in the end of the bar, which receives the clamping bolt. This bolt has two holes through it to accommodate the cutter in either of the two positions in which it is used. A sleeve with corresponding holes abuts against the end of the bar and the cutter is slipped through these holes in the sleeve and clamp bolt, after which the bolt is tightened to secure the cutter in place.

FIG. 5. KNURLING TOOL HOLDER PROVIDED WITH COARSE, MEDIUM, AND FINE KNURLS.

These boring-bars are made in four sizes with capacities for all sizes of bars ranging from 3-16 inch in diameter to 1⅛ inch in diameter. This tool-holder holds either round, hexagonal or octagon bars with an equally efficient grip, the clamp securing a four-point contact on bars of any of these shapes. A plain solid bar with straight and angular cutters at opposite ends is also provided for use in connection with these holders.

Knurling Tool Holder.

Fig. 5 shows the Williams knurling tool which is fitted with three pairs of knurls carried in a revolving head. These knurls provide for handling coarse, medium and fine work, and any set of these knurls may be instantly brought into the operating position by revolving the head. It will be seen that there is a hole in the side of the holder for the purpose of enabling the pins to be driven out when it is desired to put new knurls in the holder. The knurls and the pins on which they revolve are made of carefully heat-treated tool steel. The size of the shank of this holder is ½ by 1⅛ inch by 6⅝ inches, and the size of the standard knurls is 3-16 by ¾ inch.

FIG. 6. THREADING TOOL HOLDER WITH LOCKABLE SPRING HEAD.

Threaded Tool Holder.

The distinctive feature of the threading tool-holder shown in Fig. 6 is the provision of a lockable spring head which provides a solid head for the hold-

er when used for taking heavy roughing cuts, after which the lock may be loosened to provide for taking the finishing cut. The lock by which this result is secured consists of a bolt, the head and nut of which have an annular V-groove cut on the inside. These grooves fit over coresponding V-bearings on the holder, and, when the bolt is tightened, it locks the spring head of the holder so that it is perfectly rigid.

When it is desired to use the holder as a spring tool for finishing operations, it is merely necessary to loosen the bolt through part of a turn. The cutter is held in place by the form of locking cam already described. This tool is adapted for all classes of threading operations from the coarsest to the finest, and its lockable spring head is also especially well adapted for other classes of lathe work. These holders are made in three sizes with capacities for square cutters, 1/4, 5-16 and 3/8 inch in size, respectively.

Planing Tool Holders.

Two noteworthy advantages are secured by the use of a separate serrated adjustment ring in connection with the planing-tool holder. First, the serrated ring provides twenty-eight positions in which the cutter may be set, so that any desired adjustment may be obtained without the necessity of grinding the tool. Second, the ring may be made sufficiently hard so that the pressure of the cut will not result in the cutter wearing down its bearing and the entire holder becomes worthless. The use of a separate ring allows the remainder of the holder to be left soft so that it possesses the necessary strength to resist the intermittent strains which would be likely to result in breaking the holder at the neck, if the entire shank were hardened to provide the necessary durability for the cutter bearing.

Another feature is that the serrated adjustment ring makes it only necessary to turn the nut on the locking bolt through a half turn in order to loosen it sufficiently to adjust the position of the cutter. Reference to Fig. 7 will show that the washer under the nut on the locking bolt is provided with a spherical bearing on its under side. This permits the bolt to adjust its position to compensate for the strain of the cut without any tendency to bend the bolt and introduce transverse stresses in it. Either square or rectangular cutters may be used. In addition to its use for planing, this tool is especially adapted for use on the heavier classes of lathe work—particularly those where off-set tools are required. The holder is made in six different sizes with capacities for cutters ranging from 5-16 by 7-16 inch up to 7/8 by 1 1/8 inch in size.

FIG. 8. BOLT FASTENING PARTS AND SERRATED ADJUSTMENT RING.

Fig. 8 shows the bolt fastening parts together with the serrated adjustment ring.

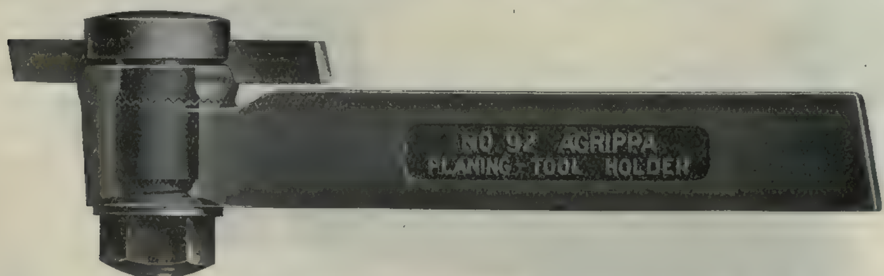


FIG. 7. PLANING TOOL HOLDER WITH SERRATED WASHER.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

THE Department of Trade and Commerce, Ottawa, has received from D. H. Ross, Trade Commissioner at Melbourne, copies of twenty-one standard specifications of materials used by the Western Australian Government Tender Board. These specifications for the most part cover supplies required by the Railway Department, and embrace the following materials:—

Specification.

No. Material.

212—Steel axle forgings.
211—Steel blooms.
203—Flat spring steel.
202—Round spring steel.
207—Mild steel.
206—Mild steel for locomotive boilers.
257—Wrought iron.
199—Copper plates and bars.
215—Steel tires.
229—Brass tubes for boilers.
236—Wheels and axles.
235—Wrought iron steel centres.
249—Cast steel wheel centres.
12M—Galvanized iron wire, 400 lbs. to mile.
13M—Galvanized iron wire, 200 lbs. tc mile.
14M—Galvanized iron bind wire, 60 lbs. to mile.
15M—Galvanized iron joint wire, 20 lbs. to mile.
16M—Hard drawn copper line wire.
17M—Soft copper binding wire, 50 lbs. mile.
18M—Copper jointing wire, tinned, 20 lbs. mile.
21M—Galvanized stay wire.

The specifications have been forwarded to the department to be retained permanently for the information of tenders, and the secretary of the Tender Board has arranged to furnish the department with a copy of the tender form for any supplies required. With this, and by means of the standard specifications referred to above, Canadian manufacturers will be afforded an opportunity of tendering for the oveasea requirements of Western Australia. The majority of the tenders are called simultaneously at Perth and London, and are usually returnable seven weeks from the date of calling. The department will be advised of the date of closing when the tender forms are forwarded. Interested Canadian manufacturers may inspect the standard specifications, particulars of which are given above, on application to the Department of Trade and Commerce, Ottawa. (Refer file No. A 1435.)

Made in St. John, N.B. Display.—An unusually interesting display was made this week in the hardware store of T. McAvity & Sons, in King Street. Much has been said and written in favor of the "Made-in-Canada" movement, and the slogan has become universal throughout the Dominion, but this was a "Made-in-St.-John" display, and it presented an appeal of much patriotic and civic interest. The display consisted entirely of articles produced in the company's big workshops and factory here, and filled several windows.

In one window was shown a variety of iron body globe and gate valves; another displayed ship pumps of different kinds; in another as seen an exhibit of locomotive mountings; while still another contained an extensive display of brass finishings. Besides these, there were many other articles giving an idea of the diversity of products manufactured by the local concern which has a market throughout all parts of Canada and many other quarters of the world.

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Vol. XIII. MARCH 25, 1915 No. 12

PRINCIPAL CONTENTS.

THE EMBARGO ON SHELL PRODUCTION KNOWLEDGE.

THE big row in Europe seems to have made everybody more or less querulous and ready to clutch at the slightest pretext for its full and free exercise. Such a condition of being cannot be termed in any sense unnatural, for it is but another way of expressing our selfishness, and of course we are naturally and oftentimes by careful cultivation quite selfish. We all hold in very high estimation what we choose to call our rights, whether as individuals, as a community or as a nation. We very often also hold a highly exaggerated estimation of what constitutes these rights, and more often than otherwise it is in their defence or maintenance that we fall foul of one another.

Respect for the rights of neutrals on the part of the belligerent nations is an issue that is breeding much heartburning meantime. The placing of orders for steel rails with a Canadian mill by an American railroad has also aroused much hostile criticism on the part of the business interests concerned in that country, and the loss of opportunity to let contracts and disburse money on a scale unprecedented in our national history, for which the particular party in power happened to be in line, is without doubt keenly felt and causes many heartaches to those of the other side.

Yes, in spite of the awful carnage, the gigantic scale destruction of property, the hideous maltreatment of human beings like ourselves, the general disruption of civilization and international business intercourse, instead of our being subdued to any extent, much less to an appreciable extent, we are fault-finding to the extreme.

Querulousness and fault-finding is epidemic, and to be out of fashion means being out of business, and being out of business is not far removed from being a nonentity. We, even on choice, might be disposed to adopt the querulous attitude for the reason given, however, like honors with respect to some people, it has been thrust upon us, and our personal "growl" is not so much against being muzzled as being discriminated against.

The usual freedom of our workshops and factories has been forbidden us, yet our contemporaries across the line have had full and free access, and let us say right here that the full noon-day glare enterprise that they have shown will not be without its helpful effect and of wider and more far-reaching nature than perhaps Canadian journalistic effort could have achieved, in accelerating munitions of war production on behalf of the Allies.

As already remarked, the advantage is all on the side of the political party in power when a big spending "Bee" is proceeding, and possibly we might allege also that the advantage is entirely with neutrals when it comes to describing the manufacture of munitions of war in a technical journal. Thousands of dollars worth of American-made machinery has been imported into Canada during recent months and who shall say that we are yet far away from the preliminary stage. "Necessity knows no slogan," and our Empire patriotism such that occasion for quibbling there is none.

We assume that there is very little, if any, of the usual business competition in this shrapnel shell manufacture. As far as we can learn, no concern desirous of engaging in it will be turned down. Many firms, however, would like to know something of the various operations and processes before taking the plunge, and others again would welcome information relative to more successful accomplishment. Ordinary business competition as we said already does not enter into the work, and in addition to the profitable output feature the widespread distribution of which in these trade depression times is so desirable, isn't there a patriotic flavor to the disposition to let the other fellow know how to make good?

The information as to how to manufacture profitably first quality shrapnel shells by every possible, known and practical method and through the medium of every type machine tool and attachment should be, and should have been long ere this, imparted to our factory staffs and mechanics, and while the embargo has so far prevented us bearing a part except in a rather indirect way, we feel that neutral journalistic enterprise has paved the way to lift the embargo placed on their belligerent brethren and made appreciably imminent some such condition as we have sought to contend for.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 9 50	$10 00
Copper, crucible	11 00	11 50
Copper, unch-bled, heavy	11 00	11 50
Copper, wire, unch-bled.	11 00	11 50
No. 1 machine compos'n	9 50	10 00
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 00	9 50
No. 1 brass turnings	7 00	7 25
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal
Standard				
¼, ⅜ in.	64	47	....	....
½ in.	69	56	....	....
¾ to 1½ in.	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in.	74	61	73	60
4½, 5, 6 in.	....	....	72	59
7, 8, 10 in.	....	....	68	56
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	41	....	....
½ in.	63	50	....	....
¾ to 1½ in.	68	55	....	....
2 in.	68	55	64	51
2 , 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in.	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload	$16 50	$16 75
Electrolytic copper	16 25	16 50
Castings copper	16 00	16 25
Tin	58 00	60 00
Spelter	12 00	15 00
Lead	5 25	5 75
Antimony	21 00	25 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh.	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4⅜c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 100-lb. kegs, per cwt	6.75
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.69
Linseed oil, raw, single bbls.	0.84
Linseed oil, boiled, single bbls.	0.87
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch	$8.00
5/16 inch	5.35
⅜ inch	4.60
7/16 inch	4.30
½ inch	4.05
9/16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	30 & 5%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.40
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. galvanized)	4 50	4 50
Queen's Head, 28 B.W.G.	4 60	4 60
Fleur-de-Lis, 28 B.W.G.	4 30	4 30
Gorbal's Best, No. 28	4 60	4 60
Viking metal, No. 28	4 20	4 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., March 23.—General trade conditions continue to improve and a more optimistic spirit keeps prevalent in business circles. In normal times this would naturally be expected at this particular season of the year. It is therefore satisfactory to note that, considering abnormal conditions, a revival is taking place this spring, although not to the same extent as in former years. The increasing volume of trade is largely due to the orders for military equipment and supplies, although the necessity for replenishing depleted stocks is also partly responsible.

The scarcity of tonnage is seriously affecting the export trade and steps are being taken to relieve the situation as far as is possible, under the circumstances. Ocean freight rates have advanced considerably, which is also causing much concern among merchants. The trade returns for February make a favorable showing although there was a considerable decrease in trade for the fiscal year just closed. It is satisfactory to note that the exports for February were nearly double those for the corresponding month last year.

Steel Market.

There has been a little improvement in the steel market although business is considerably under normal. The build-

ing trade continues very quiet and manufacturing interests are, in many cases, far from busy. The demand for steel for shells is increasing and those plants making the forgings, etc., are very active. A number of specifications for steel bridges have been sent out and consequently there will be a better demand for structural shapes. The large order for steel rails recently taken by the Algoma Steel Co. from the Illinois Central Railroad has aroused considerable interest. While this will have a beneficial effect of keeping the company's rail mill busy it has established a precedent for low prices, and it remains to be seen what effect this will have on future business. It is, however, a credit to the company that they are able to produce rails at such a low figure and at the same time, of such high quality.

Prices have advanced on Pittsburgh steel bars, beams and angles for immediate delivery, and the new quotation is $1.15. All brands of galvanized sheets are higher due to the increased cost of spelter. Galvanized pipe has also advanced on account of the spelter situation; the new discounts are given in the selected market quotations.

Pig Iron.

There is no change in the pig iron situation, business continues dull and in small tonnages.

Machine Tools.

The improvement noted last week has been maintained the orders being almost entirely for shell machinery. Preparations are being made for working on lyddite and the larger type shells; engine lathes and drills being mostly in demand. Some of the contracts for machine tools for the new Technical School have been awarded, details being given in the Industrial News Section. It is interesting to note that a number of the tools will be built in Canada.

Supplies.

The demand for machine shop supplies is steadily improving and is better than it has been for some time. There are few price changes to note this week, the most important being linseed oil, which has jumped to 84c per gallon, representing an advance of 12c. This sharp advance is due to the high price of flaxseed. Turpentine has advanced 1c and is now firm at 69c per gallon. Price lists of brass goods are still withdrawn, but the revised prices may be issued any time. Leather belting is firm but unchanged.

Metals.

The demand is improving, but buying is still of a hand-to-mouth order. Conditions are still under normal and the high prices are entirely due to outside influences. The primary markets continue to show strength although there was a break in the tin market in London last Thursday. It has, however, recovered and is again advancing.

Copper.—The general tone of the copper market is strong and the situation unchanged. The demand from Europe continues very heavy. Lake copper is quoted at 16¾c per pound.

Tin.—The British Government has placed an embargo on the export of tin, with the result that considerable excitement has been created in the London market. There was a sharp break there last Thursday. The market, however, soon recovered and quotations have again advanced 4c. A shortage of spot tin is being felt and the market is unsettled. Prices are more or less nominal at 60c per pound.

Spelter.—The market is quieter but very firm. The general situation is unchanged and supplies are still difficult to obtain. Local quotations are nominal and unchanged at 15c per pound.

Lead.—The market is quiet but firm on the expectation of higher prices. Lead is quoted at 5¾c per pound.

Antimony.—The market is very firm and an advance is anticipated. English brands are scarce and prices are nominal. Antimony is quoted at 25c per pound.

Aluminum is unchanged at 23½c per pound.

CANADIAN RAILROAD STATISTICS.

CANADA has given cash aid to railways to the amount of $233,772,640, according to the report of J. L. Payne, Comptroller of Statistics, just issued. Of this amount, $178,834,529 was contributed by the Dominion, $37,023,275 by the provinces, and $17,914,836 by municipalities. The cash aid to railways last year was $16,106,319, of which the Dominion gave $15,106,319.

Land Grants.

Land grants up to 30th June last were as follows:

	Acres.
By the Dominion	31,864,074
Province of Quebec	1,198,650
Province of British Columbia	8,119,221
Province of New Brunswick	1,647,772
Province of Nova Scotia	160,000
Province of Ontario	624,232
Total	43,613,949

Earnings Dropped.

The gross earnings in 1913 were $13,619,164 less than they were in 1914, when they amounted to $243,083,539, the decline being equal to 5.6 per cent. The gross earnings in 1884 were $33,421,705; in 1894, $49,552,528, and in 1904, $100,219,436.

Sources of Earnings.

The sources of gross earnings last year were as follows:

Passengers	$62,012,296
Mails	2,500,176
Express	6,444,214
Baggage, parlor cars, etc.	1,607,517
Freight	165,753,731
Station and train privileges	1,044,737
Telegraphs, rents, etc.	3,720,868

The gross earnings per mile were $7,893.60, a loss of $856.90, as compared with 1913, but it should be remembered in this connection that there have been put in operation 5,395 miles of new line.

Railway Equipment.

The additions to equipment in 1914 were:—Locomotives, 328; passenger cars, 306; freight cars, 21,969. During the past three years 77,032 of the latter have been put into the service and complaints of car shortage are reported to have ceased.

Following is a comparison between 1907 and 1914 of the number of locomotives and cars per 1,000 miles of track:

	1907.	1914.
Locomotives	156	176
Freight cars	4,783	6,636
Passenger cars	162	195

Railway Employees.

On 30th June last there were 159,142 employees in the service of Canadian railways, and the aggregate of salaries and wages paid was $111,762,972. Salaries and wages were equal to 62.43 per cent. of the total operating expenses. The average rates of remuneration, which have been steadily ascending for a considerable number of years, made further slight advances.

Accidents.

Railway operations for the year ended June 30, 1914, resulted in death to 600 persons and injury to 4,037. Of the deaths, 565 were caused by the movement of trains. The classes of persons affected were as follows:

	Killed.	Injured.
Passengers	27	415
Employees	224	3,161
Trespassers	289	279
Non-trespassers	48	114
Postal clerks, etc.	12	70

One passenger in every 1,868,091 was killed, and one in every 116,175 injured. Eighty-one persons were killed and 122 injured at highway crossings. Of the killed, 44 were trespassers at the time, presumably at protected crossings in cities and towns.

Operating Mileage.

The operating mileage was increased in 1914 by 1,491, bringing the total up

to 30,795 miles. Here is how the railway mileage has grown since 1864.

1864	2,189
1874	4,331
1884	10,372
1894	15,627
1904	19,431
1914	30,795

Capitalization.

The capital liability of operative railways stood at $1,808,820,761 on 30th June, 1914, showing an increment of $276,990,069 for the year. This capitalization was divided as follows:—Stocks, $853,110,653; debenture stock, (C.P.R.), $173,307,470; funded debt, $782,402,636.

Stocks increased by $107,844,383 during the year, and bonds by $169,145,686.

The Canadian railways last year carried 46,702,280 passengers and 101,393,989 tons of freight. As compared with 1913 there was an increase of 471,515 in the number of passengers carried and a decrease of 5,598,721 in the number of tons of freight hauled. The tonnage grew from 48,097,519 in 1904, to 101,393,789 in 1914. The average receipts per mile per passenger was 2.007 cents, while the average of ticket sales per passenger was $1.328. There was an average of 59 passengers per train as against 62 in 1913. The average journey was 66 miles, the average number of passenger cars per train was 4.2, and the average number of passengers per car 14.

FIRST CONTINGENT TRANSPORT PAYMENTS.

A statement of payments to steamship companies for the transport of the first contingent to England was given in the House of Commons on Feb. 23. The ships were refitted as transports at the expense of the Government, the cost of victualling being also borne by the Government. The payments were:—

Allan Line—Corinthian , $17,841.20; Grampian, $36,635; Scandinavian, $29,440; Scotian, $25,116; Sicilian, $17,831; Tunisian, $25,734.

Atlantic Transport—Manhattan, $34,142; P. V. G. Mitchell-Manitou, $30,461; Lapland, $39,056.

Red Star—Zeeland, $28,964.

White Star—Megantic, $36,198.

Dominion Line — Canada, $45,819; Laurentic, $72,464.

Canadian Northern—Royal George, $54,243.

Canadian Pacific—Ruthenia, $17,992; Tyrolea, $18,335; Montezuma, $20,342; Montreal, $21,033; Monmouth, $9,915; Virginian, $26,175.

Canada Steamship Lines—Bermudian, $20,184.

Cunard—Alauma, $65,237.

Robert Reford Company—Andania, $48,928; Franconia, $66,578; Invernia, $69,486; Saxonia, $69,578; Cassandia, $38,590; Lakonia, $22,805.

Donaldson Line—Athenia, $42,184.

Royal Mail Steam Packet Company—Arcadian, $21,751; Caribbean, $14,171.

Canadian Northern—Royal Edward, $45,080.

Thompson Line—Devonia, cancelled, $1,938. The cost of fitting and victualling approximated that of the hire of the ships.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Trade Gossip

Wallaceburg, Ont.—The Wallaceburg Brass Co. have received an order for a large number of plugs and sockets for shrapnel shells.

Renfrew, Ont.—The Renfrew Machinery Co. has now completed its building for the manufacture of shrapnel shells for the British War Office. The machinery has been installed, and work will be commenced this week.

Geo. B. Jackson of Guelph, Ont., has established a factory for making railway signal torpedoes. At a later date machinery will be required for making lead tubes and railway signal fusees. For making the latter, mixing machines will be required, also paper tube rolling and filling machines.

Errata.—In the article dealing with the Armstrong-Whitworth Co. new plant at Longueuil, Que., in Jan. 28 issue of Canadian Machinery, reference was made to motor generators supplied by Bruce Peebles & Co., Ltd., Edinburgh, Scotland. This should have been motor converters and not motor generators as stated.

The Terry Steam Turbine Co., of Hartford, Conn., announce that their Chicago office will be located in the Peoples' Gas Building with A. W. de Revere in charge. The company has also opened an office in the Michigan Trust Building, Grand Rapids, Mich., in charge of A. L. Searles, to cover the southern peninsula of Michigan.

Dominion Steel Corporation Activity.—Operations in all departments of the Dominion Steel Corporation, with the exception of the rail mill, are reported by the president, J. H. Plummer, to be proceeding at 60 per cent. of the company's total capacity, and the prospects are bright for a continuance to that extent.

Munitions of War Production.—Speaking recently of the compensation to be made to persons whose factories the Government might commandeer under the Amendment to the Defence of the Realm Act, introduced in the House of Commons by Chancellor of the Exchequer Lloyd George, the latter promised that everything possible would be done to reduce inconvenience and loss. Continuing, he said: "It is, however, a matter of life and death with this Empire that we increase enormously our supplies of munitions of war, in spite of the possible loss to individuals. The national needs are so overwhelming that I hope those who are inconvenienced in the matter of contracts will put up with it."

Wagon Cover Order.—Having almost completed an order from the Government for some six thousand kit bags for the Canadian troops, the Western Tent & Mattress Co., of Calgary, is now about to start on another order of four hundred transport wagon covers. The kit bags mean about $4,000 to the firm, while the wagon covers mean another $9,000.

Bullet Lead.—Six thousand tons of pig lead, sufficient to make six hundred million rifle bullets of standard weight, was shipped on March 18 from the Omaha, Nebraska, branch of the American Smelting and Refining Co., direct to London, where it will be used by the allies in manufacturing bullets. When loaded, the shipment filled ten trains of twenty cars each, and in each car were thirty tons.

Moral Conduct Appeal.—The Carnegie Steel Co. of Pittsburg has issued an appeal to its thousands of employees to lead a moral life as a means of increasing their own safety while at work and of improving their chances for promotion. If to be good is to be successful, it will not be the company's fault if its workers who accept the advice do not develop into benevolent and rich old gentlemen like its founder.

Demand for Powder.—President Pierre S. Dupont, of the E. I. Dupont de Nemours Powder Co., announces that sufficient orders have been received from the belligerent powers to warrant the company in making large extensions to its plants. "Our expenditure in construction may reach $5,000,000 or more," he said. Land has already been purchased on the James River, in Virginia, for a new factory for the manufacture of dynamite and gunpowder.

Canadian National Exhibition—It is announced that two firms have made application to instal a plant at the Toronto Exhibition this year to demonstrate their shell-making abilities. There are also applications in from a couple of rubber firms asking for space in order that the manufacture of rubber goods be shown. The Exhibition authorities are elated by the large number of firms who have applied for space to show goods in the process of manufacture.

Shell Orders From Russia.—The largest single order for war materials yet recorded among the many already placed in the Dominion has just been let by the Russian Government to the Canadian Car & Foundry Co., Montreal and Amherst, N.S. The order is for shrapnel shells of various calibre, and the amount of the order, it is stated, is practically limited only to the capacity of the company and of such sub-contractors in Canada and the United States among whom it may be divided.

Edison and Toluol Production.—According to the New York Herald, Thos. A. Edison, the inventor, may have a considerable interest in the Dominion Steel Corporation new toluol plant at Sydney. Mr. Edison is building a plant at Johnstown and another may be built at a place not yet decided upon. The construction of the plants is referred to as a gamble on the duration of the war. "As soon as the war is over, Germany will make carbolic acid much cheaper than I am making it," he said. Ultimate victory, however long delayed, must, he thinks, rest with the allies. The toluol product used in the manufacture of high explosives, which promises to be a profitable adjunct to Dominion Steel's business, has risen enormously in value since the war started.

Machine Tool Contracts Placed.—The following contracts have been placed for machine tools for the new Technical School, Toronto:

Fourteen 14-in. engine lathes and two 14-in. tool room lathes built by the Canada Machinery Corporation, Galt, awarded to the A. R. Williams Machinery Co., Ltd., Toronto.

One precision lathe, Rivett make, awarded to the Canadian Fairbanks-Morse Co., Toronto.

Twenty-three 14-in. woodworking lathes, to the Preston Woodworking Machinery Co., Preston, Ont.

One 20-in. swing, patternmakers lathe, to Wm. Garlock, Toronto, representing the American Woodworking Machinery Co.

Small metal working tools to the Aikenhead Hardware Co., Toronto.

Small woodworking tools to the British-American Hardware Mfg. Co., Toronto.

Work benches to the Robt. Simpson Co., Toronto.

Hamilton, Ont.—The Dominion Sheet Metal Co., capitalized at $300,000, has decided to build a factory here for making galvanized sheets. A. T. Enlow of Oshawa will be manager.

Algoma Steel Corporation.—A contract for 35,000 tons of 90-pound rails has been placed by the Illinois Central Railway with the Algoma Steel Company. Under the terms of the contract the delivery of the rails will be subject to what is known as the "nick-and break test," which is regarded by steel experts as the most severe form of testing rails. The contract, which will total almost $1,000,000, was accepted by the Canadian company upon the basis of $27 a ton, which was $5 a ton less than the next nearest American competitor.

Electrical

Tara, Ont.—The council are contemplating installing a hydro-electric lighting system.

Newmarket, Ont—The Toronto & York Radial Railway Co. will commence work on the electric lighting system this week.

Orillia, Ont.—The Orillia Water, Light and Power Commission has made a reduction of 10 per cent. on all existing light and power rates.

Toronto, Ont.—Tenders closed on March 25 for a brick transformer house on Sterling road for the Toronto Electric Commission. Particulars obtainable at the Duncan street station.

Toronto, Ont.—The New Toronto Power, Light and Water Commission, in agreement with the Etobicoke Township Council, have decided to take over the entire operation of the extension in the township.

Kincardine, Ont.—The electric light and water commission has under consideration a plan for the improvement of the street ilghting system. A committee composed of W. J. Henry, J. B. Watson and Superintendent Ingram has been selected to look into the matter.

General Industrial

Oil Springs, Ont.—A company is being formed to manufacture cement tiles. The Board of Trade has the matter in hand.

Greenfield, Ont.—The municipal council are receiving tenders up to April 10 for about 20,450 lb. of twisted steel reinforcing bars. J. D. Cameron, clerk of Kenyon Township.

Thorold, Ont.—Pilkington Bros., Ltd., will build an addition to their plant. Austin Bros., Cleveland, Ohio, are the contractors.

Leamington, Ont.—The Heinz Company here are duplicating their vinegar factory, making thereby a very important extension to their establishment.

Toronto, Ont.—Fire destroyed the mattress factory of the Whitworth & Restalls Co. on March 17. The damage is estimated at $20,000, part of which is covered by insurance.

Renfrew, Ont.—Allan Francis and A. A. Wright were in Peterboro and Toronto recently investigating machinery for the manufacture of ice cream with the view to installing a plant in the Renfrew Creamery.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Welland, Ont.—E. R. C. Clarkson & Son, liquidators of the Canadian Automatic Transportation Co. of this town, announce that they have sold the plant to W. C. Carr, who was largely interested. It is the latter's intention to carry on the manufacture of the same electrical devices as were made by the old company.

Hamilton, Ont. — The Procter & Gamble Co., who are erecting a million and a half dollar plant in the east end, have decided to erect another large building, approximately 500 by 175 feet, in addition to the five large buildings now under construction. All the buildings in this new plant are of steel construction and built in with white pressed brick.

Saskatoon, Sask.—Directors of the Northern Flax and Fibre Co., a large American corporation, with headquarters at Great Falls, Montana, will make a visit to Saskatoon in the near future, to arrange for the immediate installation of a flax mill here. This news has been received at the Board of Trade offices after lengthy negotiations for the location of a mill here.

Toronto, Ont.—The modern two-storey fertilizer plant of Gunn's, Limited, St. Clair Avenue, West Toronto, was totally destroyed by fire early Saturday morning. The loss is estimated at $40,000, which is covered by insurance. The building contained several tons of potash. A large quantity of expensive machinery was also totally destroyed. It is the intention of the company to rebuild immediately.

Preston, Ont.—At a special meeting of the Board of Trade it was decided that the ratepayers purchase the property given by the town to the Anchor Bedding Co. of Toronto and turn it over to a company which proposes to manufacture wooden handles. The bedding company failed after the ratepayers agreed to loan them $25,000 and provide a free building site, and the buildings are now valued at $24,580.

Municipal

Markham, Ont.—It is proposed to install a waterworks system. James Loudon & Hertzberg, of Toronto, are the engineers.

London, Ont.—The Dominion Government will make a grant of $5,000 for each of three subways that it is proposed to construct. The total cost for each subway is estimated at $50,000.

Newmarket, Ont.—At the regular meeting of the town council held last Monday it was decided to install a new reservoir at the waterworks. The reservoir, which will cost $2,500, will be made of reinforced concrete.

Bracebridge, Ont.—By-laws will be voted on by the ratepayers on April 12 to authorize raising $4,000 for new pumps; $2,700 for main extensions; $5,300 for other improvements in connection with the waterworks system.

Ottawa, Ont.—At a recent meeting of the city council, the motion of Controller Ellis to ask the Legislature to approve of raising $400,000 to provide for the building of the Lemieux Island overland pipe was carried without dissension.

Brockville, Ont.—The special committee of the Water and Light Departments and the Board of Health have recommended the construction of a rapid sand filter plant of the gravity type, at a cost of $85,000, and that a new 24-in. intake

pipe to run 500 feet into the river be purchased, the intake estimate being $7,000.

Owen Sound, Ont.—Two Toronto men have been here looking over the site for the proposed municipal elevator. They met members of the Board of Trade, and will submit estimates on the cost of a half-million-bushel concrete elevator, to be owned and operated by the town. The cost will be about $200,000, according to preliminary figures.

Lindsay, Ont.—The Canadian Boving Co. industrial by-law will be re-submitted to the property owners of Lindsay at the earliest possible date, providing the report of the auditors at present working on the company's books proves satisfactory. The original by-law was to authorize a bond guarantee of $30,000, but it was turned down.

Tenders

Victoria, B. C.—Tenders will be received up to Monday, April 5, 1915, for the following water meters: 25 1-inch, 10 1½-inch, 12 2-inch, 3 3-inch, 1 4-inch. Specifications may be seen at the office of W. Galt, the city purchasing agent.

Toronto, Ont.—Tenders will be received up to March 30, 1915, for the complete supply and installation of extension to electric lighting system and fixtures at the premises of Toronto Jail, Gerrard street east. Copy of specification may be seen and tender form obtained at the offices of the Property Department, City Hall, Toronto.

Adamsville, Que.—Tenders will be received up to March 31 by the undersigned for the building of the iron work only of an iron bridge, 130 feet long. Plans and specifications can be seen at the secretary's office at any time. Municipality of the East Part of the Township of Farnham. O. Landry, Sec.-Treas., Adamsville, Que.

Toronto, Ont.—Tenders will be received up to April 10, 1915, for the construction of four concrete piers and two concrete abutments at Bridge 107.2, Muskoka Subdivision, over Shaw's Creek, about 7½ miles south of Bala. Forms of tender may be obtined and plans and specifications seen at the office of the resident engineer, room 510, Union Station.

Montreal, Que.—Tenders for the supply and installation of underground cables; lamps and lamp-standards, and concrete foundations for same; for underground street lighting distribution on St. Catherine and Bleury streets, will be received by the Board of Commissioners until Tuesday, April 6, 1915. Specifications, forms of tender, and all required information, may be obtained at the office of the Superintendent of Purchases and Sales, City Hall.

Fredericton, N.B.—Tenders will be received at the Department of Public Works, Fredericton, until March 31, 1915, for constructing the steel superstructure of a new bridge, to take the place of the present wooden highway bridge at Moncton over the Petitcodiac River; one through fixed riveted steel truss span of 355 feet from centre to centre of end bearings; four through fixed riveted steel truss spans of 261 ft., 6 in. from centre to centre of end bearings, according to plans and specifications to be seen at the Public Works Department, Fredericton, N.B. John Morrissy, Minister of Public Works.

Vancouver, B.C.—Tenders will be received up to March 31, for the supply of the following articles for the use of the B.C. dredging fleet at Vancouver, B. C., for 12 months ending March 31, 1916: Hardware; packings; Manila rope; wire rope; chain; steam pipe; valves and fittings; oils and greases; paint, paint oils, etc.; hose; brooms and brushes; steel castings. Forms of tender may be obtained at the office of G. B. Hughes, district engineer, Victoria, B.C.; at the office of C. C. Worsfold, district engineer, New Westminster, B. C.; and at the office of J. L. Nelson, supt. of dredges, 614-18 Birks Building, Vancouver, B.C.

Toronto, Ont.—Tenders will be received by the Chairman of the Board of Control, City Hall, up to Tuesday, March 30, 1915, for the supply of: Sweeper body and equipment for Toronto civic railway, St. Clair Avenue division. Equipment for machine shop for Toronto civic railway, Danforth Avenue car barn. Mechanical and electrical equipment for car bodies for Toronto civic railway, Lansdowne Avenue extension. Four car bodies for Toronto civic railway, Lansdowne Avenue extension. Coal for water supply section. Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section of the Department of Works, City Hall, Toronto.

Ottawa, Ont.—Tenders will be received at this office until Wednesday, April 7, 1915, for the construction of one new chain of buckets, tumblers, together with spare parts, for dredge "Mastodon." Plans, specification and form of contract can be seen and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of A. Kastella, Esq., mechanical superintendent, Birks Building, Ottawa, Ont.; J. L. Nelson, Esq., supt. of dredges, Vancouver, B.C.; G. B. Hughes, Esq., district engineer, Victoria, B.C.; C. C. Worsfold, Esq., district engineer, New Westminster, B.C.; F. Y. Harcourt, Esq., district engineer, Port Arthur, Ont.; J. M. Wilson, Esq., acting district engineer, Toronto, Ont., and A. E. Dubuc, Esq., district engineer, Montreal, Que.

Contracts Awarded

John T. Hepburn, Ltd., Toronto, received the contract from that city for the annual supply of cast-iron special castings, at $1.82½ per 100 pounds.

Ottawa, Ont.—A contract has been awarded by the city council to T. Lawson & Sons of this city, for supply of iron castings, service posts, etc., at $2.40 per 100 lb.

Winnipeg, Man.—The Dominion Bridge Co. has been awarded the contract for the construction of the Lee river bridge on the way to the Point du Bois power plant at $19,383.37.

Welland, Ont.—The General contract for the construction of an addition to the plant of the Canada Forge Co. has been awarded to the Standard Steel Construction Co., the estimated cost being $12,000.

Toronto, Ont.—Contracts for large special castings for waterworks requirements in North Toronto have been awarded to Canadian Allis-Chalmers, Ltd., Reid & Brown Structural Steel and Iron Works, Ltd., and the John Inglis Co.

Railways-Bridges

Kenora, Ont.—James Fraser, Government road and bridge inspector, sent out this week a number of men with pile driver supplies, etc., to build a new bridge over Rice creek in the northern portion of Melick township. The new bridge will cost about $900.

Penticton, B.C.—At a meeting of the Board of Trade it was informally announced that the Great Northern Railway will go ahead with its proposed line up the Okanagan from Oroville to Penticton. This line will give Penticton connection with Vancouver.

Ottawa, Ont.—The Commons Railway Committee on March 11 passed the bill allowing the amalgamation of the Toronto, Hamilton & Buffalo Railway and the Erie & Ontario Railway. The T. H. & B. now extends from Brantford to Buffalo, and is operated by the C. P. R. The Erie & Ontario is partly built, and is to extend from a port on Lake Erie

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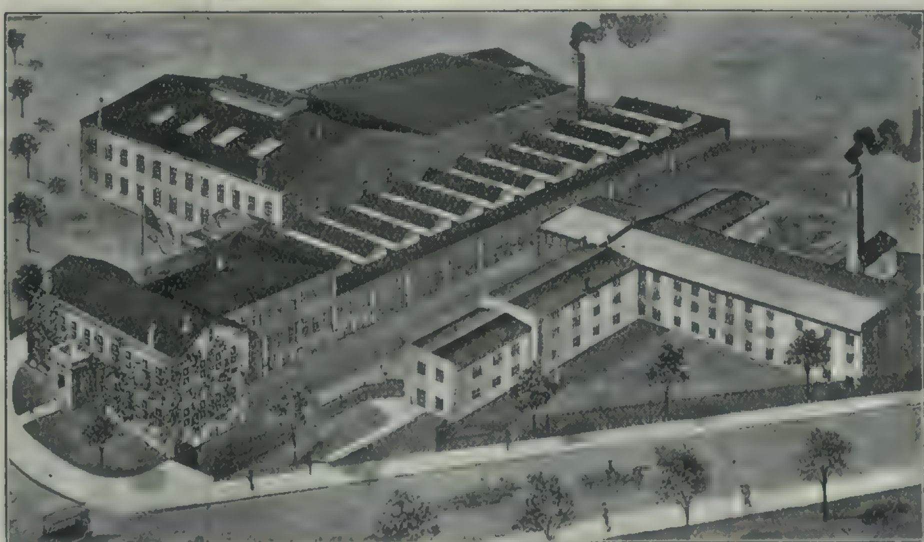

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north through Brantford to join the C. P. R. main line.

Toronto, Ont.—It is reported that the Toronto-to-Guelph Electric Railway is to be finished and in operation by the end of July or by August this year. The steel is laid; the ballasting of the road is to be rushed to completion. The electrification of the road has also commenced. The railway is 46 miles long, stretching from Toronto to Lambton, Cooksville, Meadowvale, Huttonville, Norval, Georgetown, Limehouse, Acton, Eden Mills, to Guelph. The completion of the road represents an investment of approximately $3,000,000. Three transformers are to be built, one at Guelph, the plans of which are under way, one at Georgetown, and one near Toronto, probably on the Dundas road.

Canada Watches Lakes.—That Dominion authorities fear the laying of mines in various Canadian harbors was expressed in a communication received by Roscoe House, lighthouse inspector of the Buffalo district. The notice advised that it was probable that the ports of Quebec, Halifax, N.S., and Esquimalt, B.C., would be closed at various times to allow government vessels to sweep the harbors, to assure all merchant marines safety in arrival or clearance. To warn vessels that entrance is prohibited to these harbors, three red lights will be shown by night and three red balls by day. Shipmasters sighting these must keep to sea or anchor at points charted as "examination anchorages." Examining vessels, so designated by lights or flags, will meet incoming boats there. When these ports are open for navigation, three white vertical lights by night or corresponding signals by day will be shown.

New Incorporations

The James Frid Co. has been incorporated at Ottawa, Ont., with a capital of $100,000 to carry on the business of general contractors at Toronto, Ont. Incorporators: J. W. Frid, A. Frid and M. Boag, all of Winnipeg, Man.

Daly & Morin, Ltd., has been incorporated at Ottawa, Ont., with a capital of $500,000 to manufacture window shades, curtain poles, etc., at Lachine, Que. Incorporators: W. J. Daly and A. Morin, of Westmount, Que., and T. J. Shallow, of Montreal, Que.

The Canadian Horse Shoe Co. has been incorporated at Ottawa, Ont., with a capital of $300,000 to manufacture horse shoes, toe calks, etc., at Hamilton, Ont. Incorporators: G. H. Long, Llewellyn F. Stephens and H. J. McKenna, all of Hamilton, Ont.

A want ad. in this paper will bring replies from all parts of Canada.

The John Goodison Thresher Co. has been incorporated at Ottawa, Ont., with a capital of $1,000,000 to manufacture agrictutural implements, steam and gasoline engines, etc., at Sarnia, Ont. Incorporators: J. Goodison, E. F. Goodison and C. MacKenzie, all of Sarnia, Ont.

The Municipal Concrete Construction Co. has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on business as general contractors at Berlin, Ont. Incorporators: J. Callahan, R. J. Gibson and Clara Johnston, all of Sudbury, Ont.

The McCormick Mfg. & Supply Co. has been incorporated at Toornto, Ont., with a capital of $40,000 to carry on business as brass and iron founders and engineers at Welland, Ont. Incorporators: F. H. Rice, M. Misener and A. Reid, all of Welland, Ont.

The Ontario Flax Co. has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on the business of cultivating, treating and dealing in flax, hemp and other fibres. Head office at Toronto, Ont. Incorporators: A. L. McCredie, R. L. Defries and G. G. Paulin, all of Toronto, Ont.

Knechtel Bros., Ltd, has been incorporated at Ottawa, Ont., with a capital of $50,000 to take over the S. Knechtel Wood-Turning Co. and the Southampton Iron Works; the chief place of business to be at Southampton, Ont. Incorporators: B. O. Knechtel, G. Knechtel and O. Knechtel, all of Southampton, Ont.

Canada Iron Foundries, Ltd., has been incorporated at Ottawa, Ont., with a capital stock of $4,500,000 to acquire and take over as a going concern the undertaking and business now carried on by the Canada Iron Corporation, in liquidation at Montreal, Que. Incorporators: W. R. Lorimer Shanks, F. G. Bush and G. R. Drennan, all of Montreal, Que.

Personal

Capt. J. W Hatherly of the Allan liner Mongolian, was killed on March 17, when a hatch beam struck him. The Mongolian is undergoing repairs in drydock. Capt. Hatherly was 48 years of age, and leaves a widow and two children in Glasgow. He has been on the Mongolian two years, and sailed between British ports and Philadelphia.

William Sumbling, father of W. H. Sumbling, of the Sumbling Machine Co., Toronto, and a veteran of the Crimean War, passed away after a four days' illness at his late residence, 255 Davenport Road. The late Mr. Sumbling was

80 years of age, and was born in Buckinghamshire, England, coming to Canada in 1868.

Marine

Sarnia, Ont.—It is probable that harbor improvements, to cost $50,000, will be proceeded with this season.

Ferry Ready for Launching.—The steel car ferry Ontario No. 2 will be launched on Saturday, April 3, at 2.30 p.m., from the Polson Ironworks, Toronto.

Victoria, B. C.—The steamer Bessie Dollar will clear from this port about the beginning of April with four million feet of lumber, part of an order of twenty-five million feet destined for the harbor improvements in Toronto. She will steam via the Panama Canal.

Ship Masters Organize.—A local branch of the Ship Masters' Association of the Great Lakes was recently organized in Toronto, at a meeting in the Iroquois Hotel, at which the following officers were elected: President, Captain J. Mann; first vice-president, O. Patterson; second vice-president, N. McGlennon; secretary-treasurer, A. E. Stinson; chaplain, Captain E. Smith; marshall, Captain Jefferies; warden, H. Patterson; sentinel, — Sexsmith.

Northern Navigation Co.—The Northern Navigation Co. has issued the following list of appointments of captains and chief engineers of the steamers of its fleet: Noronic, R. D. Foote, Samuel Brisbin; Hamonic, A. L. Campbell, John Smith; Huronic, A. M. Wright, John Dow; Majestic, J. D. Montgomery, engineer not yet appointed; Germanic, F. G. Moles, S. Burgess; City of Midland, F. A. Garret, J. Osburn; Waubic, G. W. Kinnee, S. Beatty; Ionic, O. Wing, Engineer not yet appointed.

Building Notes

Weston, Ont.—A Masonic Temple is to be erected this spring on Main street by Humber Lodge A. F. and A. M. The estimated cost of the building is $10,000.

Sarnia, Ont.—The council will probably award the following contracts in connection with the rebuilding of the city hall: Mackness & Struthers, heating and plumbing; J. Filsinger, electric wiring and galvanized iron work; A. Lawson, metallic ceilings.

Montreal, Que.—Something between $800,000 and $1,000,000 may be invested in two large blocks of buildings this summer, according to plans which are

being considered now by English and Belgian capitalists. One block is for business purposes; the other will be residential. The plans for the building will be had in the office of Clarence I. De Sola, Coristine Building.

Contracts Awarded

Toronto, Ont.—The Toronto Hydro-Electric Commission at its meeting on March 18, awarded a contract worth $40,000 to the Canadian General Electric Co., for transformers to be used throughout the system. The commission has also awarded contracts for about 7,000 meters for a year's needs on the system. Chamberlain & Hookham, of Birmingham, Eng., get a share of the contract; Packards, the Northern Electric Co., and other share in the contract, which is worth about $35,000

Wood-Working

Drayton, Ont.—Buckman Bros. may extend their box factory. An expenditure of $8000 is contemplated.

Sarnia, Ont.—Word has been received that the mills of the Spanish River Lumber Co. at Cutler, Ont., on the north shore of Lake Huron, were destroyed by fire. No particulars were given.

Fort Frances, Ont.—It is understood that a deal has just been closed whereby the saw mills of the Northern Construction Co., together with all their timber limits, have been acquired by P. J. Noel, the superintendent, and D. D. McKay, a Minneapolis manufacturer and capitalist.

Hanover, Ont.—The Glaesar & Leinberger factory will again be in operation in a few days. A joint stock company, to be known as "Meades Upholstering Co., Limited," is bein gorganized and is applying for a charter. The provisional directors are: W. Meades, Dh. Taylor, R. Brunt, G. A. Rozel, and J. Jagelewski. It will be capitalized at $50,000.
Contracts Awarded— £ et

Refrigeration

Toronto, Ont.—Gunns, Limited , have taken out a permit for the erection of a cold-storage warehouse at 80 Front street. The building will cost $6,000.

Hamilton, Ont.—The property committee has under consideration a proposal to instal a cooling plant in Central market hall for the benefit of the butchers.

Book Reviews

Electric Elevators, by Elmer G. Henderson; 90 pages, $7\frac{1}{2}$ in. x 5 in. Published by the Joseph G. Branch Publishing Co., Chicago, Ill. Price, $1 post-paid. This book deals with the construction and operation of electric elevators in a practical way, all technical matter having been avoided where possible. The author is a practical elevator constructor, and is thus able to treat the subject in a manner which should be readily understood by those engaged in the construction and operation of elevators. It will, therefore, be inferred that the book was written for this class of reader. The book contains twelve chapters. The first three deal with elevators of various types, including the different arrangements of the mechanical and electrical equipment and the counter-balancing of elevator motors. The following two chapters deal with the construction of D.C. and A.C. motors. In chapters 6, 7 and 8 the construction of various types of controller are described and their relation to the operation of the elevator dealt with fully. Governor and push-button devices are described in chapters 9 and 10, while chapter 11 contains an extract from the Chicago building ordinances. The concluding chapter contains a number of useful electrical tables. The book contains 41 illustrations carefully indexed, while in addition there is the usual table of contents. The book is practical, covers the subject thoroughly and contains much useful information for those engaged upon electric elevator construction.

Catalogues

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has published bulletin No. 5001, describing a new 30-ton hydraulic pipe-bending press. A brief specification is also included, accompanied by an illustration.

The Buffalo Forge Co., Buffalo, N.Y., has recently published a series of bulletins and catalogues which contain much useful data on fans and blowers. Catalogue No. 200 describes the Buffalo planoidal fans, a modification and improvement on the older type of steel plate heating and ventilating fans with a comparatively small number of radial blades. Catalogue 201 deals with Niagara conoidal fans, and catalogue 182-E is a collection, for convenient reference, of the various types of blowers and exhaust fans, which are regularly built for direct connection to motors. This includes everything from large ventilating and drying fans down to the little "Baby" conoidals for ventilation of moving picture booths and drying cabinets, also electric blowers for single forge fires, which take less than half the horsepower of an ordinary electric lamp.

Development of Our Nickel-Copper Smelting Industry

The European War has brought this particular industry very much into the limelight, on which account information relative thereto is of more than ordinary interest and moment. The two immediately preceding articles dealt with the Mond Nickel Co. smelting plant features. In the present instance, a brief account is given of the Company's refining plant in Wales, and, in addition, considerable light is thrown on the value of nickel as a commercial, naval, military and domestic utility. The information given is more or less official.

MOND NICKEL CO. REFINING PLANT.

BEING a purely British corporation, and in view of the fact that the ore is mined and smelted in Empire territory by the Mond Nickel Co., it is only natural to expect that the refining or ultimate process, whereby the nickel product becomes a marketable commodity, should also take place within the like bounds.

Refining Works at Clydach, Wales.

The Bessemer matte is shipped from the company's smelters at Coniston via the Canadian Pacific Railway or the Canadian Northern Railway to Montreal, and thence to Swansea, Wales, near which port the company's refining works are situated. Here the matte is refined by the Mond Nickel or Nickel Carbonyl process. Five operations in all are required to produce the nickel:—

1.—Roasting to free the matte from sulphur.

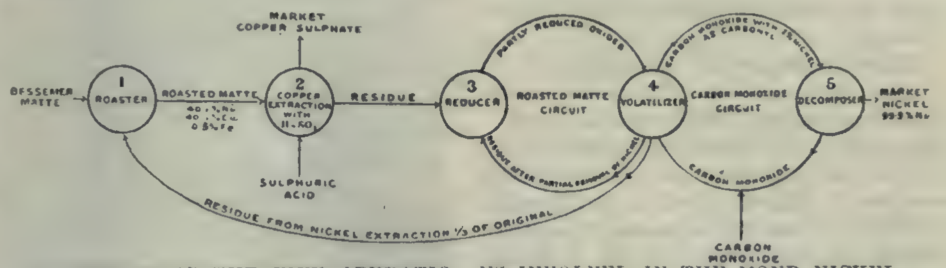
2.—Extraction of two-thirds of the copper by sulphuric acid.

3.—Reduction of the nickel and remaining copper by water gas rich in hydrogen at a temperature not higher than 400 degs. C.

4.—Treating the reduced matte in an apparatus called a "volatiliser," by carbon monoxide at a temperature not exceeding 80 degs C.

5.—The nickel-carbonyl gas produced by the previous operation passes into a "decomposed" in which it is heated to 180 degs. C., when the nickel is deposited in metallic form.

The following diagram illustrates the five operations involved in the Mond process:—



ILLUSTRATING THE FIVE OPERATIONS INVOLVED IN THE MOND NICKEL REFINING PROCESS.

The process is not completed, however, by one passage through the five stages, as only about 60-70 per cent. of the nickel has been removed from the matte by the nickel-carbonyl gas. The residue from this operation, which does not differ very much in its composition from the original matte, is returned to the first operation and follows the same course as before. In operation 5, the carbon-monoxide is released and returned to the "volatiliser," to take up a fresh charge of metal. The nickel is deposited on granules of refined nickel, which are automatically removed after they have grown to a certain size.

The product obtained contains between 99.8 per cent. to 99.9 per cent. of nickel, not including cobalt, and is the purest form of nickel which is at present obtainable in commercial quantities. The process is a continuous one, and large quantities of coal are required for it, full advantage being taken of the situation of the refining works, which are in the midst of the Welsh anthracite and steam coalfields. It is therefore possible to secure at very low cost the necessary supply of coal which in the process is largely used for power, steam and gas. The products made in the process are:—

1.—Sulphate of copper.

2.—Nickel.

3.—Nickel salts.

Copper Sulphate.

The copper sulphate is shipped from Swansea to Italy, France, and Spain, and other wine-producing countries, to be used for spraying the vines, in order to prevent mildew and other fungoid diseases. It is recognized that the spraying of sulphate of copper is the only preventative against these diseases. Copper sulphate is also used for prevention of

MOND NICKEL CO. REFINING WORKS AT CLYDACH, WALES.

diseases in other plant, for spraying potatoes, olive-trees, for killing weeds, etc.

Nickel Salts.

The nickel salts manufactured by the company are largely used in the nickel-plating industry, and also as a catalyser for fat-hardening purposes.

Company's Village at Clydach

The Mond Nickel Co. have done much in the interest and comfort of their employees. With this object in view they erected a model village near the refining works at Clydach, where comfortable and distinctive accommodation is provided for the workmen and their families.

The social activities of Clydach Village centre round its club, which was opened in January, 1909, and that it has fully justified its existence is shown by the fact that it can boast of over 500 members. The club house itself was built by the company at a cost of nearly $20,000, its main feature being a large concert hall with seating accommodation for 450, wherein fortnightly concerts are held throughout the winter. Admission is free and members are entitled to introduce their friends. There are also a billiard room with two tables, and air-rifle range, a photographic dark room, a reading room, a refreshment room and the usual committee rooms.

In the club library, which is well stocked with excellent works of fiction, biography, travel, science, etc., there are more than 1,000 volumes from which members can make their selection, while, in the reading room, technical publications, the leading daily newspapers, as well as weekly and monthly journals, are provided for their entertainment.

The Clydach club is not limited by four walls, its activities extending far beyond the actual club house. For instance, affiliated to the club are football, cricket, hockey and curling sections, and members of a musical turn of mind have an opportunity to display their talents in the brass band, orchestral, or male voice party sections. In addition, the club has a photographic section, not to mention a flourishing gardening society, in connection with which a flower show is held every year. In fact, every employee at the Mond Nickel Co. Refining Works at Clydach is pretty sure to be able to find in the club some opportunity for the gratification of his particular tastes in whatever direction they may lie.

Uses of Nickel.

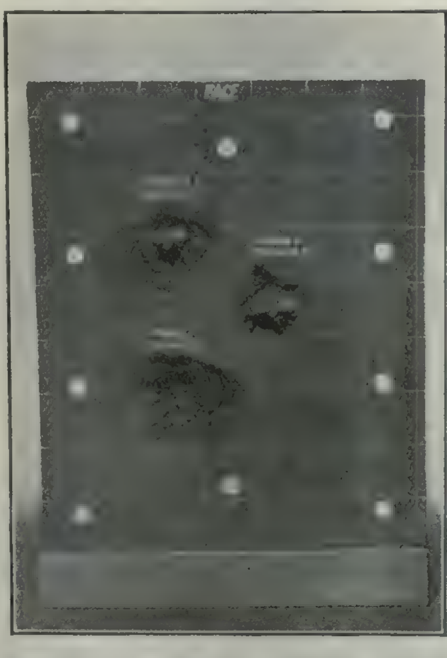
The uses of nickel are so many and are multiplying so rapidly as to be almost innumerable, and although the importance of pure nickel is growing daily, the chief use of the metal is in the production of alloys, particularly nickel steel, in which the greater part of nickel refined is still employed. The alloy of nickel and iron is no novelty, since all native iron of terrestrial as well as meteoric origin contains nickel. Moreover, as far back as 1822, experiments were made by Faraday in alloying nickel and iron, and since then improvements in the process have been made continually.

Nickel Steel.

Nickel steel has many uses and is constantly finding new applications. Steel containing from 2½ per cent. to 3½ per cent. of nickel has certain of its properties greatly improved, so that in many directions it is replacing ordinary structural steel. The following table, which shows a comparison of carbon and nickel structural steels gives some idea as to its superiority:

Characteristics.	Med. Carb. Strength	Med. Nickel Steel
Percentage of carbon	0.20	0.38
Percentage of Ni	0	3.50
Elastic limit (lbs. per sq. inch)	30,000 (Min.)	60,000 (Min.)
Ultimate strength (lbs. per sq. inch)	60,000 (Min.)	105,000 (Min.)
Modulus of elasticity	29,000,000	30,000,000
Safe working stress in tension (lbs. per sq. in.)	16,000	28,000

Perhaps the most important use to which nickel is put is for the manufacture of armour and heavy ordnance, where its great strength and toughness have proved of great value. It has been used for engines and propeller shafts for a number of years and has proved so much superior to other steels that it is now considered unrivalled for such purposes. On account of the increase in strength or decrease in weight, it has been used for crank pins, light forged engine frames, bolts for extreme hydraulic pressure, hydraulic forged cylinders and railway axles. From its peculiar resistance to fatigue under vibration, it is employed very successfully for piston rods in steam engines and drills.



OFFICIALLY TESTED ARMOR PLATE FOR BATTLESHIP—MADE BY SIR. W. G. ARMSTRONG, WHITWORTH CO. MOND NICKEL USED IN MANUFACTURE.

The value of nickel steel for armour plates, when cemented and face-hardened, consists not only in its greater resistance to penetration, but in its non-fissibility. So completely is this recognized, that since the Washington Navy Yard first began experimenting with nickel steel in 1876, every country in the world has come to rely on nickel steel for the armour-plating of its first-class ships of war. Incidentally, it may be mentioned here that nickel prepared by the Mond Nickel Co. is largely used in the manufacture of armour-plates for the British Government.

Nickel Steel for Bridge Building.

There is also an increasing demand for nickel steel for the building of bridges. Nickel steel is being used for the rebuilding of the Quebec bridge which collapsed so disastrously a few years ago. It also entered largely into the construction of the Manhattan bridge at New York. This is the heaviest suspension bridge in existence, and for its length the heaviest bridge of any kind in the world. Although its span is 140 feet less than the span of the big cantilevers of the Forth Bridge, the enormous load which the bridge is designed to carry calls for a weight of cables and suspended superstructure that makes it by far the heaviest and strongest bridge yet constructed.

The suspension bridge proper, disregarding the approaches, consists of a main span 1,470 feet long and two side spans, each 725 feet in length. The total width of floor is 120 feet. A novel feature is the use of nickel steel in the upper and lower truss chords, which are subjected to a working stress of 40,000 lb. per square inch. The nickel steel rivets are subjected to a working stress of 20,000 lb. per square inch, and notwithstanding the higher cost of the nickel steel, the saving in weight is such as to make the trusses actually cheaper than if they were built entirely of ordinary structural steel. The weight of steel in the superstructure from anchorage to

anchorage exclusive of the cables, is 10,500 tons of carbon steel and 8,000 tons of nickel steel. The weight of the cables is 6,300 tons and the total weight of steel in the whole bridge, including anchor chains, cables, towers, and suspended span, is 42,000 tons. The following table shows the approximate saving in weight and cost of bridges effected by the use of nickel steel:

Mixed nickel and carbon steel—saving in weight up to 25 per cent; saving in cost up to 17 per cent.

Nickel steel throughout—saving in weight 10 to 30 per cent.; saving in cost up to 12 per cent.

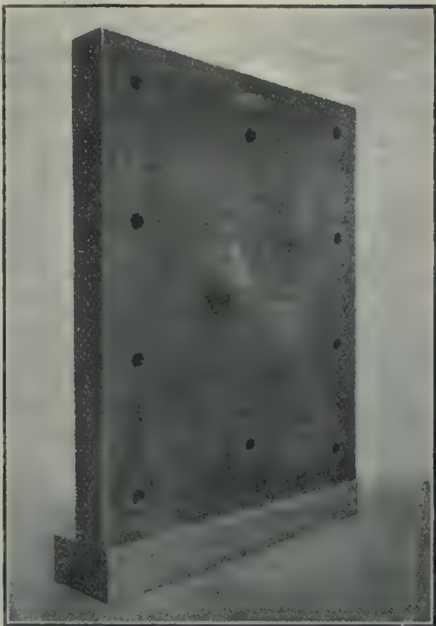
General Uses.

Nickel steel is especially suitable for motor car parts, because it possesses high tenacity and is very durable and has a remarkable co-efficient of expansion. For this same reason it is particularly well adapted for steel rails, and in places liable to special stress it is much used. For instance, it is estimated that in a sharp curve one nickel steel rail has a life as long as that of four rails made of ordinary steel.

Nickel steel is also used in wire cables, torpedo defence netting, electric lamp wire, corset wire, mountings of lenses, mirrors, balances for clocks, weighing machines, springs, cutlery, harness mounting, boiler tubes, axles, brake-beams and transoms for field artillery wagons as used by the French Army since 1898.

Currency

A great many countries have adopted nickel or nickel alloy for the manufacture of small currency, for the reason that only nickel and nickel alloy completely fulfil the requirements of such currency. The metal used must be comparatively cheap, of handsome appearance, not liable to oxidation or alteration by any chemical agent; and it must be not too difficult to mould, roll, punch and stamp; be capable of taking a good impression of the die, durable in wear and difficult to counterfeit.



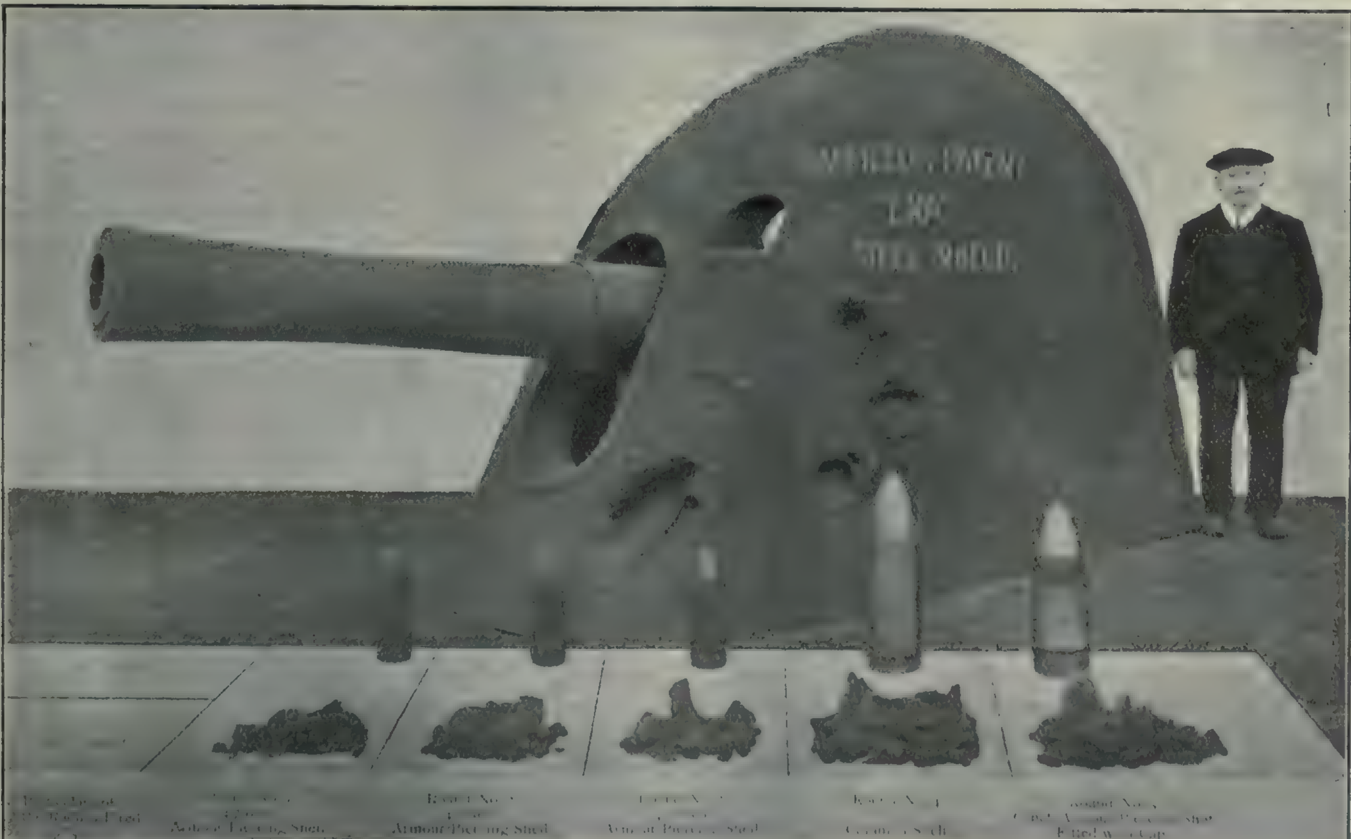
OFFICIALLY TESTED ARMOR PLATE FOR BATTLESHIP MADE BY SIR. W. G. ARMSTRONG. WHITWORTH CO. MOND NICKEL USED IN MANUFACTURE.

Formerly, pure copper was most frequently used for the commoner coins in nearly all countries. It is cheap and easy to work, but very liable to oxidation and too soft. Moreover, the risk of counterfeiting can scarcely be avoided, as copper can be had everywhere and offers no difficulty in working.

Bronze has also been tried in order to enhance the hardness of copper, but the coins of this alloy suffer from nearly all the disadvantages of those made of pure copper.

German silver, which is an alloy of nickel, copper and zinc, has been used for coins in various states of South America, but although better than copper and bronze, it oxidizes too readily and soon loses its bright appearance. German silver, with an addition of pure silver, was tried by the Swiss Government, but the coins made of this alloy soon became yellowish and unsightly, and Switzerland has since adopted pure nickel and nickel alloy for its coinage.

Small copper coins coated with silver have been used in many countries, but the silver coating soon wore off and the appearance of the coins became so paltry



PROJECTILES MADE FROM NICKEL STEEL, MANUFACTURED BY HADFIELD'S STEEL FOUNDRY CO., SHEFFIELD, ENGLAND. MOND NICKEL USED FOR NICKEL STEEL.

and the dirt stuck to them to such a degree that many countries in which they were in use discarded them altogether.

The first experiments with alloys of nickel and copper were made in the United States and Belgium. The compositions varied from 10 per cent. nickel and 90 per cent. copper to 50 per cent. nickel and 50 per cent. copper. In both these countries and later in several others (including Germany) it has been proved that an alloy of 25 per cent. nickel and 75 per cent. copper possesses to a high degree the qualities desirable for material for small currency. Coins of this alloy being harder than bronze, the material being much dearer, and greater skill and a powerful plant being required to work them, it is practically impossible for counterfeiters to produce imitations with any chance of success.

It is only a few years ago that a process was discovered to roll, hammer and stamp pure nickel, and already the governments of Austria-Hungary, Italy, Switzerland, Denmark, Montenegro, Mexico and other countries are being supplied with coins of this metal. These coins are the most excellent that have ever been made, are most durable in wear, they never oxidise and it is simply out of the question to endeavor to counterfeit them successfully. How widespread is the use of nickel and nickel alloy for small currency can be seen by the following table of the countries which have adopted nickel coinage:

Argentine	Japan
Austria-Hungary	Jamaica
Belgium	Kiatchaow
Bolivia	Luxembourg
Bulgaria	Mexico
Brazil	Montenegro
Ceylon	The Netherlands
Congo	Nigeria
Chile	Peru
Columbia	Portugal
Corea	Persia
Costa Rica	Paraguay
Crete	Phillipine
Denmark	Panama
Egypt	Roumania
Ecuador	Reunion
France	Servia
Germany	Switzerland
Greece	Siam
Guadaloupe	Salvador
Guatemala	United States of America
Hayti	
Honduras	Uruguay
India	Uganda
Italy	Venezuela

Kitchen Utensils.

The remarkable properties of nickel, which approaches the precious metals in its chemical powers of resistance, while far exceeding them in hardness and toughness, have in later years led to its employment, firstly for cooking utensils and kitchen ware, and secondly in an ever-increasing degree, for cookers, dishes, basins, baths, crucibles, stills and hollow vessels of every description used throughout the technical arts.

Indeed, as a metal for cooking utensils, nickel is the ideal. Tinned or "tin" vessels (sheet iron coated with tin) are mostly thin and very liable to injury, while enamelled vessels have the great drawback that the enamel coating is liable to chip. Thus, when damaged enamel utensils are used the food comes into contact with the iron and is apt to acquire a metallic flavor. There is also the great danger of detached chips of enamel being swallowed with the food.

Copper cooking utensils undergo strong oxidation, and can only be used provided they have a thick inside coating of tin. This coating wears away very rapidly and has often to be renewed; thus there is always the danger of the formation of poisonous copper salts which dissolve in the liquid food. Copper utensils under any circumstances mean a great deal of work for the kitchen staff, for every time after use they must be not only washed, but scoured to remove the discolorations caused by the fire. One of the main advantages of the use of nickel kitchen utensils is that they do not require tinning.

ARMY COOKING CHEST MADE OF PURE NICKEL.

Nor do cooking utensils made of aluminum provide a satisfactory substitute for copper or iron. The melting point of aluminum is comparatively low, so that it is extremely sensitive to the action of heat, and vessels of aluminum unfilled with water frequently melt if they are put on a strong gas flame or fire. More-

ARMY FIELD KITCHEN—INTERIOR FITTINGS OF PURE NICKEL.

over, the constant recurrence of a dull gray layer of oxide necessitates constant scouring; and aluminum, being exceedingly soft, requires specially careful and delicate handling in this operation. Aluminum is also dissolved in liquid food and forms metallic salts which may sometimes be poisonous.

All the dangers and disadvantages enumerated are entirely absent from nickel utensils. Pure nickel does not oxidise like iron, copper or aluminum; it is harder than these metals, and is therefore much more durable; it may be, therefore, described as positively indestructible. Pure nickel utensils, moreover, when worn beyond possibility of further service, still retain a high metal value.

ARMY FIELD KITCHEN—INTERIOR FITTINGS OF PURE NICKEL.

Field Kitchen Appliances.

From the ordinary barrack's cooker, it is only a short step to the manufacture of field kitchen appliances, for, owing to the great strain and rough treatment to which military cooking appliances are exposed, they must be made of a material:

(a) — Which possesses sufficient strength and durability to withstand even the rough handling inevitable in the field.

(b)—Not liable to injury, even if the cooker be wrongly heated—i.e., when empty or insufficiently filled.

(c)—Which is faultless from a hygienic standpoint, and precludes every possibility of injury to health.

(d)—Which does not require repair in field such as would inevitably happen with copper and iron, owing to the necessity of re-tinning.

Pure nickel alone is capable of responding to these varied requirements. The field-kitchens for military purposes are designed in such a way that they can prepare the food for 250-260 men in the course of a few hours, even during marches.

A further article for the efficient feeding of troops, especially mountain troops, is the cooking-chest. This consist of a pure nickel field kettle of about 5.72 gallons capacity, together with an iron under-frame for heating. The kettle and hearth or under-frame telescope into each other and are put into a chest made of veneered wood, lined with asbestos straw, oil-paper and cork. The chest is fitted in such a way as fully to retain heat. Some hours before the meal is required, the food is heated to boiling temperature, and the kettle is then put into the chest; the latter closed and mounted on the saddle, and during transport the food becomes thoroughly cooked. The design of the chest is so ingenious that after 18 hours with an outside temperature of 30 deg. F., the food is still found to have a temperature of 182 deg. F.

EXPERIENCES IN ELECTRICAL MACHINERY OPERATION.*

By E. C. Parkham.**

When an a.c. generator supplies underloaded transformers and induction motors, the current of the generator lags behind its e.m.f. Under this condition more exciting current must be furnished by the exciter if the alternating voltage is to be maintained at normal. (The effect of lagging armature current is to cause the magnetizing action of a given armature coil to oppose the magnetizing action of that field pole which it is opposite. This decreases the resultant field cut by the armature conductors so that they do not generate as high an e.m.f. as they do when the voltage and current are in phase and the opposing armature reaction is at a minimum. In other words, a lagging current tends to demagnetize the field poles, and, if normal voltage is to be maintained, the field strength must be restored by increasing the amount of current drawn from the exciter.)

Exciter Commutation Trouble.

An operator complained that his exciter commutated badly and that he was unable to keep up the voltage on the alternator. These two symptoms in themselves suggested that an overload was the trouble and excessive heating of the exciter confirmed this suspicion. Since the exciter circuit included no ammeter its output was not shown. An inspector cut in an ammeter which indicated the exciter to be continuously overloaded 40 per cent. The operator then stated that the exciter was guaranteed to maintain normal a-c voltage at 0.8 power-factor and that his power-factor was better than 0.8. Rough calculations based on station wattmeter, ammeter, and voltmeter readings showed that the power-factor was between 0.55 and 0.60 at the time of the readings. The operator was well enough satisfied with these results to substitute a larger exciter for the work.

Hot Box Indications.

If trouble of any kind occurs in layouts that involve electrical apparatus it is usually the case that some one of the electrical devices is promptly blamed as being the cause. Apparently it never occurs to many operators that troubles may arise from abnormal conditions in the connected load.

In a certain instance an operator complained to the power company that the voltage supplied was varying widely and was causing speed variations in an induction motor that was driving a centrifugal pump. The power company failed to see how this could be possible but, to satisfy the consumer, applied a recording voltmeter, which showed the voltage to be well maintained. On looking further for the trouble, it was found to be due to a hot box on the pump shaft; the box would alternately bind and release, thereby causing the motor speed to vary according to this variable load which was imposed upon its regular load. (The operator should have observed that voltage variations could not have been the cause of trouble because other induction motors on the same service were not affected.)

A short time afterward, the same pumping unit, after working all day, refused to start on closing the control switch the next morning. The panel starting-contactor closed promptly, but operator reported the motor was "dead." It took an inspector about five minutes to find out that there was nothing wrong with the motor. On turning the rotor back to let out the back-lash due to the belt coupling, and closing the control switch, the rotor promptly took up the back-lash, but refused to rotate further. An investigation showed the trouble to be in the same pump bearing that had given trouble before; it was now frozen tight. A new lining, plenty of oil, and a smooth shaft remedied matters.

Burn-Out Due to Core Loss.

A solid iron core would offer such a low resistance to the eddy currents set up by the core cutting the magnetic lines of the field that these currents would be very large and cause prohibitive heating. Laminations, when insulated from each other, introduce resistance, and thereby reduce the volume of current in the core to a very small value.

A certain armature had been burned out by the power current that followed a lightning discharge to the core. The damaged coils were removed, the core cleaned and scraped, and new coils installed. The machine ran without trouble for several months and then burned out again in the same place. Attributing the second failure to poor repair, about twice as many coils were removed as before and the machine again repaired. Before it had a chance to fail again, the operator had a whiff of burning insulation investigated and found excessive heating, which was confined to the repaired area.

An "armature man" was called in. On removing the repaired coils, inspection disclosed that the insulation armor of some of them was being burned from the outside; the cotton insulation on the wires was in good condition, showing that the trouble did not come from within. The armature was stripped, the core disassembled to and including the burned area, several inches of new laminations installed, and the coils replaced. On drying out and again placing the machine in service, no tendency to heat more in one place than in another was exhibited.

The cause of the heating had been the burning together of the laminations; the effect was equivalent to having a part of the core made of solid iron.

*General Electric Review.

**Construction Department, General Electric Co.

New Westminster, B.C.—John and Harry Shull, the managing directors of the Shull Shingle Mill Co., which is building a large plant on the North Arm of the Fraser river in Burnaby, are making final arrangements for the operation of the mill, which they anticipate opening by June 1.

Machining Shrapnel Shell Cases, and the Tools Employed

By J. Thompson

Just as there is a wide distribution of orders for the machining of 18-pounder shrapnel shell cases, in like manner is there more or less diversity in method and procedure adopted relative to their quality and quantity output as finished products. A thoroughly practical demonstration of how to achieve the desired end profitably is given in accompanying article.

THE importation of tools and equipment with which to prosecute the manufacture of British 18-pounder shrapnel shells has been one of the outstanding features which has

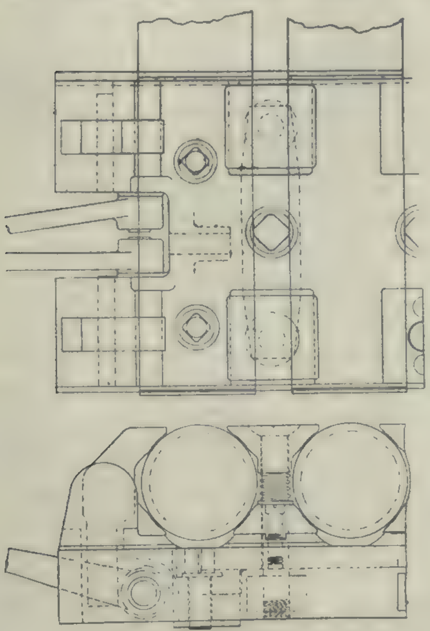


FIG. 1.

marked the prodigal quantity distribution of shell orders to Canadian industrial concerns since the advent of the European War. The present article deals with the machine tool equipment designed and manufactured by the Potter & Johnston Machine Co., Pawtucket, R.I., of which many Canadian firms have installed units more or less liberally.

First Setting, Forged Shells.

Six or more shells are placed in a fixture fastened to the table of an automatic milling machine, the method of holding, and type of fixture used, being as shown in Fig. 1. There is a continuous cutting-off and milling of each end on account of there being two tables on the machine. The method of placing the shells in the fixture to insure their being of one length is obtained by the use of a gauge prior to the shell being tightened down in fixture. Two shells are set at once and the gauge slides on the side table. Fig. 2 shows the side view of the gauge, and Fig. 3 a sectional view of the fixture. While one table is in operation the other is being emptied of its finished work and rough material put in. The next step is to place a shell on the expanding pin arbor, and by means of a drawback mechanism, it is held true with the inside. The driving is done by means of a binding screw, which presses down on the shell exactly over one of the pins. Fig. 4 shows the method of holding.

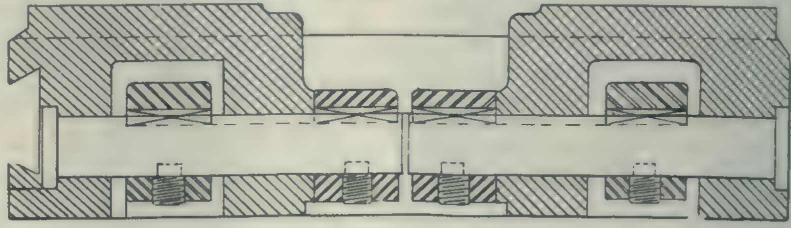


FIG. 3.

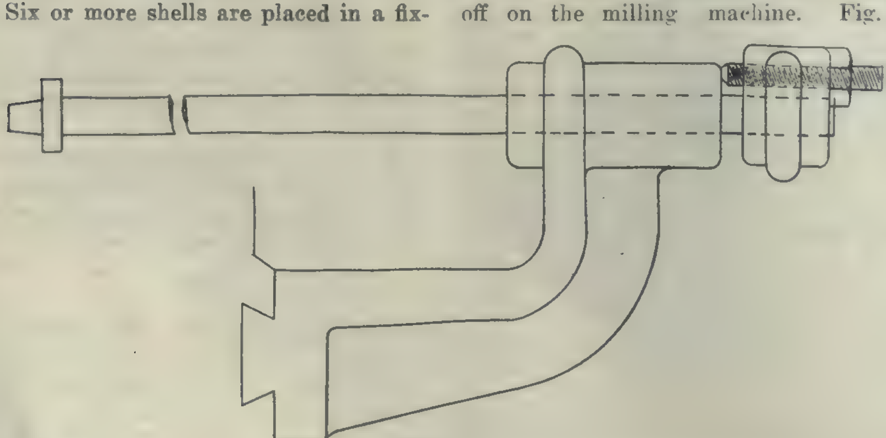


FIG. 2.

The next operation is the rough turning of the shell—approximately $7\frac{1}{4}$ in. long. At the same time, the end of the shell is faced off to length by means of an end mill inserted in the turret. Removal of excessive stock by this end mill is the cause of lots of trouble and care should be exercised in the cutting off on the milling machine. Fig. 5 shows the holder fastened on to turret with the end mill in place.

The next turret face is used for finish-turning of the body as far as the wave or at most, ⅛ of an inch beyond. Also, while finish-turning this body part, the radius is put on at the same time. Fig. 6 shows the holder with the radius and turning tool in position.

The next operation is the under-cutting and dove-tailing. The under-cutting tool is held on the cross slide block, the cross slide operating longitudinally with the turret, and operating by means of a separate cam and a separate drum. This cutter passes under the shell, and, by this means a correct size is always secured. Fig. 7 shows the cutter held in

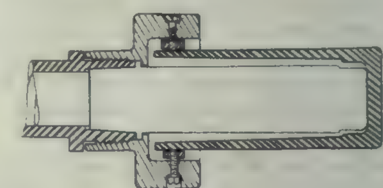


FIG. 4.

the block. While this cutter is in operation, it is necessary to hold it rigidly, and this is done by means of a revolving ball-bearing thrust collar held in the turret.

At the same time as this under-cutting is done, the dove-tailing is put in. The dove-tailing tool is fastened on the turret face, and the small slides are op-

FIG. 5.

erated by means of a push-block which is fastened on the cross slide block, Fig. 7. These small slides are set in the block or holder at the required degree, and the cutters of the hook nose type are fastened in these slides, and are adjustable (back and forth). Great care must be exercised in the setting of these tools, as the least little dis-adjustment will cause the shell to be rejected on ac-

count of the slot being too wide. To get the required depth of dove-tail, adjusting screws are fitted. Fig. 8 shows the method of cutting the dove-tail in shell.

After the under-cutting and dove-tailing is finished, the waving is cut in.

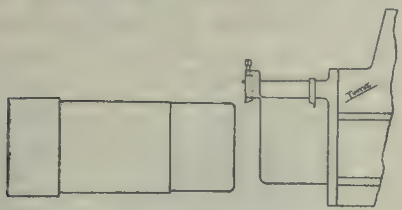


FIG. 6.

This waving is done by means of a bar sliding in a block which is fastened on the cross-slide, Fig. 9. At the end of the sliding bar there is a roll which runs up against the face of the scroll fastened on the spindle nose. This scroll or spindle nose cap has the correct wave

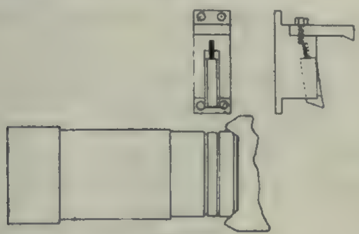


FIG. 7.

cut in it, and the roll is kept up against the face of the scroll by means of a spring inserted in the under part of the sliding bar.

There is always tension on this spring and more so when the roll is up against the scroll face. It is necessary to have

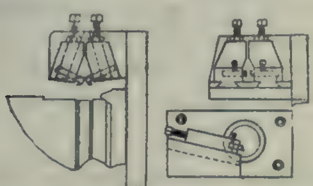


FIG. 8.

this spring quite strong to insure a perfect wave on the shell. The cutter is held in the sliding bar and is made with two small recesses or vees. It is adjustable and set at an angle, and can taken out and ground and put back without much trouble. While this cutter is in operation, it is necessary that the shell

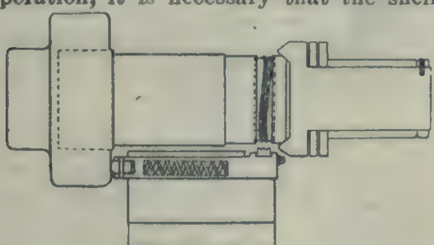


FIG. 9.

be held rigidly and this is obtained by means of a revolving, thrust-bearing washer.

All of these tools constitute the first setting for machining the shell, a general lay-out of the tools being shown in Fig. 10.

Second Setting, Forged Shells.

For the second setting, the shell is

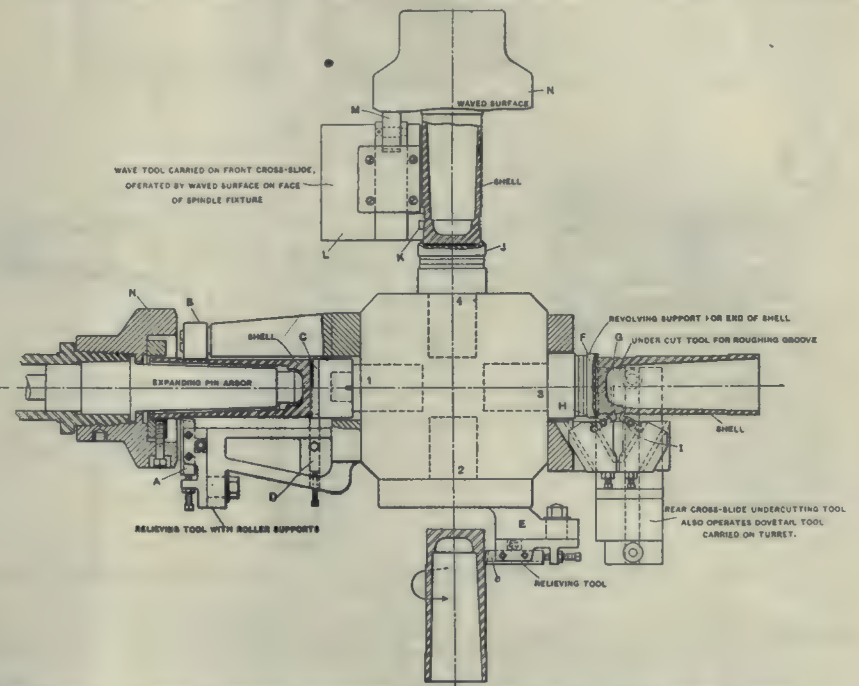


FIG. 10. TOOL LAYOUT, FIRST SETTING FOR MACHINING SHRAPNEL SHELL FORGINGS.

placed in a collet chuck operated by a drawback mechanism. This collet is

FIG. 11.

ground out in the machine, thereby insuring the shell to run positively true. It is gripped substantially and with no possible means of slipping. The shell being in place, the first turret face holds the boring bar for boring out the powder pocket. At the same time, the shell is

FIG. 12.

turned at the open end to a diameter larger than that of the body in the previous operation. The turning tool holder is fastened on the turret. Fig. 11 shows the boring bar and turning tool.

The next operation is the boring out of

FIG. 13.

of the diaphragm seat. This is done by means of a fluted reamer which is taper. Fig. 12 shows the reamer in place for machining the seat. At the same time as this seat is machined, the taper is cut as well. The next operation is the finishing of the powder pocket, Fig. 13.

The next operation is the taper turning on the open end of the shell, or forming the end preparatory to the nosing in. The taper turning is done by means of a tool fastened in a block on the cross-slide. The push-rod works the opposite way to the tool, and is operated from the turret, to which is fastened a steel block.

In some cases it has been found necessary to use a large reamer for reaming

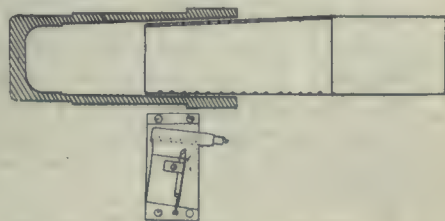


FIG. 14.

out the inside of the shell to get the correct weight. This is done by means of a large taper reamer fastened in the turret, working in conjunction with the

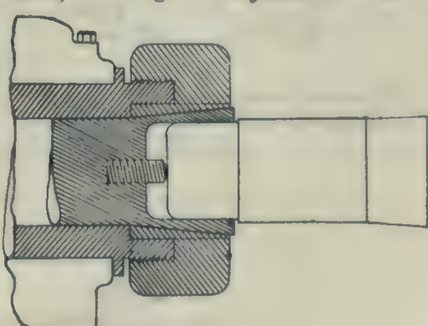


FIG. 15.

taper turning tool. Fig. 14 shows the taper turning tool and reamer in position, and Fig. 15 the method of holding

the shell. All these tools constitute the second setting and Fig. 16 shows the lay-out of tools.

Before the third setting, the shells are sent to the heat-treating department to be hardened, and great care has to be exercised in this feature in regard to Government requirements for strength. Following this comes the nosing-in. The shells are placed with the open end in a lead bath and heated, and the nosing-in is done by means of a press and a formed die.

For the third setting, the shells are held in place by means of a collet chuck gripped further along the body than in the second setting. The first turret face constitutes a rough boring bar which holds the roughing cutter and a finishing cutter as well. The face of the shell is also finished by means of a flat cutter inserted in the bar.

The second turret face consists of a forming boring bar operated by means of a formed block fastened on the cross-slide. The second turret face is used for rough forming the inside one inch from the back of the thread.

The third turret face is used for finish-turning the form one inch back from the thread, while the fourth turret face is used for threading, a collapsible tap being used. Fig. 17 shows the method of holding and the lay-out of tools. The foregoing constitutes the machining of 18-pounder shrapnel shells from forgings.

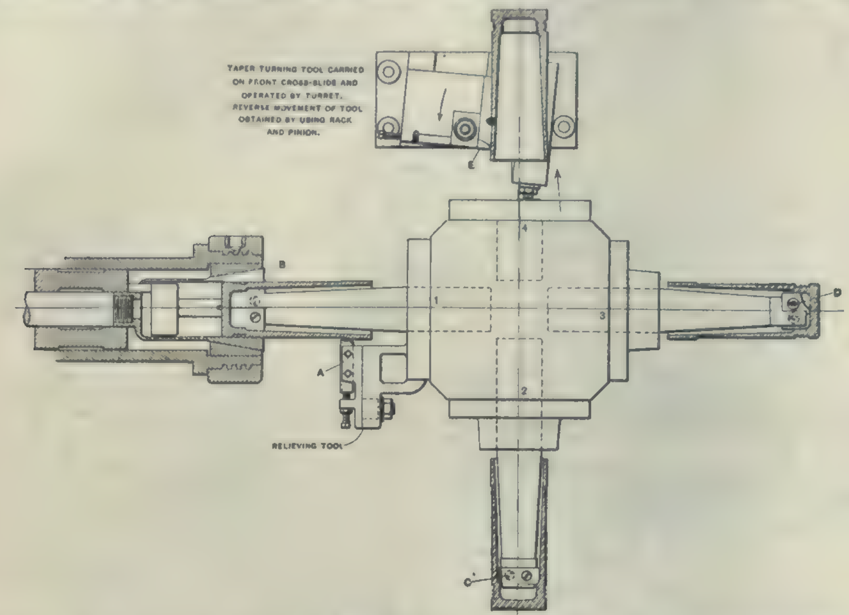


FIG. 16. TOOL LAYOUT, SECOND SETTING FOR MACHINING SHRAPNEL SHELL FORGINGS.

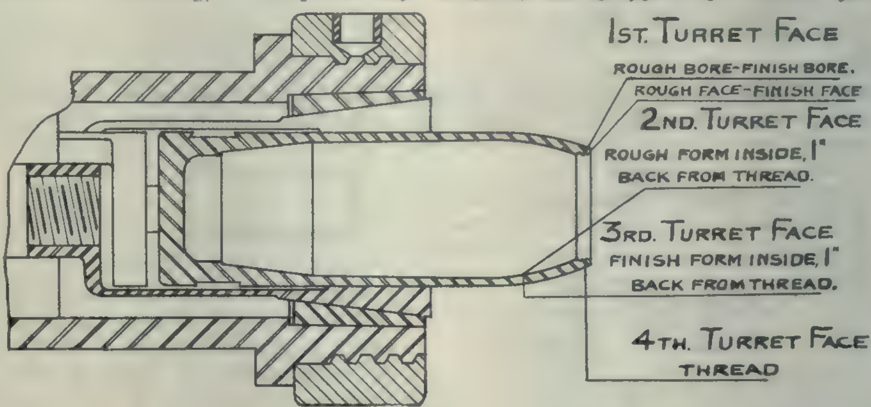


FIG. 17.

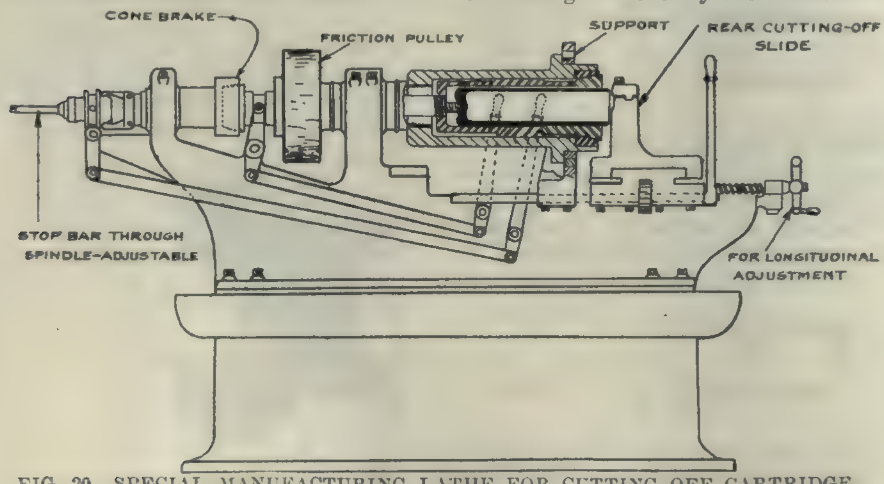


FIG. 20. SPECIAL MANUFACTURING LATHE FOR CUTTING OFF CARTRIDGE CASES.

Lyddite Shells.

In addition to making the shells from forgings, bar stock is used. The stock is cut off into lengths and gripped by means of chuck jaws fastened on a 16-in. scroll chuck, Fig. 18. The turning, facing end, under-cutting, dove-tailing and waving are done as already described. Fig. 19 shows the method of holding the shell for the second operation, when applied to the manufacture of lyddite shells.

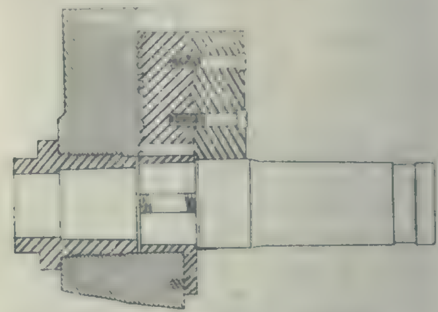


FIG. 18.

There are two ways of machining lyddite shells and both can be done to good advantage. In the second method, and first setting, bar stock is cut off in lengths, and gripped by chuck jaws. First turret face—rough-turn outsde up to the chuck jaws, rough drill hole and counter bore nose end. Second turret face—rough form nose, bore hole and powder pocket, and rough counter bore. Third turret face—finish form nose and finish turn outside diameter, finish counter bore. Fourth turret face—Thread.

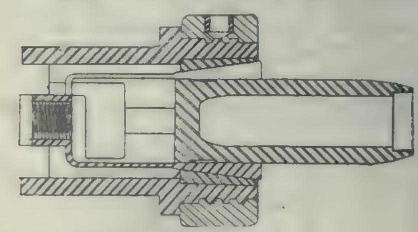


FIG. 19.

Second setting, first turret face—Grip body by means of a collet chuck, rough turn remaining stock, and face end. Second turret face—Finish-turn shoulder base and put radius on closed end.

Third turret face—Under-cut with cross-slide block and dove-tail. Fourth turret face—Wave.

Fig. 20 shows a Potter & Johnston machine for cutting off cartridge cases, one such being shown in process. It is held by means of a collet chuck and operated by a drawback mechanism. Accuracy and trueness are assured as may be noted.

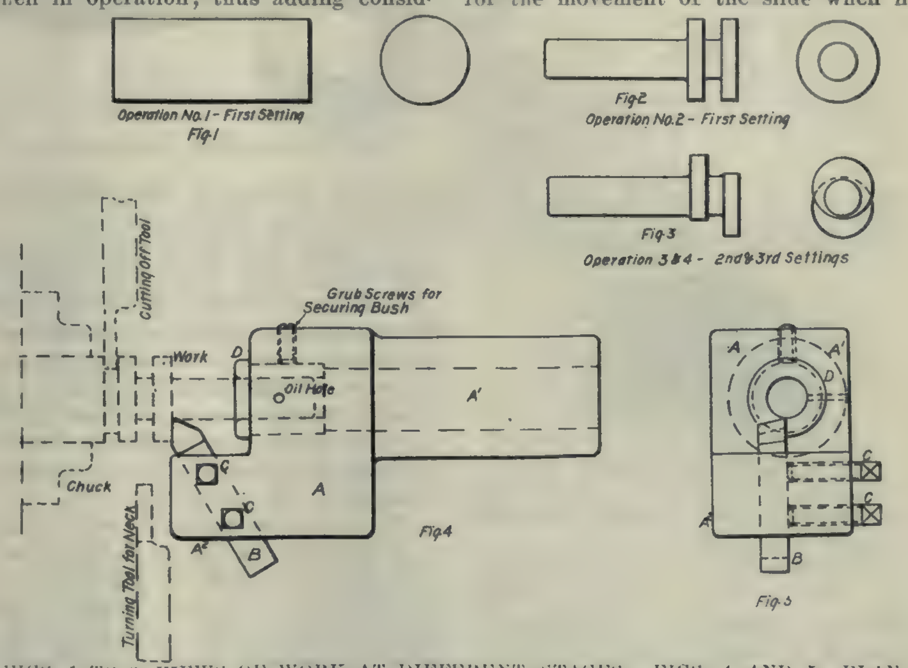
TOOLS AND FIXTURE FOR MACHINING DOUBLE CAMS.

By W. G.

THIS article is intended to describe a simple method by which a number of small double cams were machined. It may, perhaps, be worthy of mention that the operations in question were carried out on a 6 in. centre capstan lathe, the whole of the machining being performed at two settings. As the number of components required was comparatively small, it was necessary to keep down the initial cost of the tools as much as possible, but, at the same time without going to extremes and producing a set of "shoddy" tools that would in any way impair the output, or quality of the work. Perhaps this point is well worth keeping in view, particularly when designing jigs, tools, etc., for work in small quantities.

With reference to the accompanying drawings, Figs. 1, 2 and 3 are views of the work at different stages. Figs. 4 and 5 are plan and end view respectively of the tool for the second operation, while Fig. 6 is a front and end view of the fixture for the third operation.

The holder A (Figs. 3 and 4) consists of a rectangular mild steel forging, provided at its rear end with a circular shank A,' for the purpose of securing it good quality of cast steel, and should be hardened and ground. It is essential however, that a spiral oil groove be cut the entire length of the said bush, as this allows the work to be properly lubricated when in operation; thus adding considerably to the smooth working of the tool.



FIGS. 1 TO 3. VIEWS OF WORK AT DIFFERENT STAGES. FIGS. 4 AND 5. PLAN AND VIEW OF TOOL FOR SECOND OPERATION.

The third operation (turning eccentrics) is carried out by means of the fixture shown in Fig. 6 Part E is the body of the fixture. This consists of a circular cast iron face plate, provided with two rectangular projections E' and E² for the purpose of forming a slideway for the chuck plate F. The latter is made from mild steel, and consists of a flat plate having two of its edges bevelled off as shown to suit the corresponding aperture formed in the said plate. The chuck plate is further provided with a central screwed hole F' for the purpose of receiving the chuck.

It will be noticed that the front of the said hole is bored out plain, the object being to provide a register or locating recess for the chuck when screwed into the plate, thus providing means for keeping the chuck quite true. The elongated holes F² and F³ are to allow for the movement of the slide when in operation. Parts G and H are the clamping nuts and studs respectively.

The adjusting gib I is made from mild steel strip, and is held in position and operated by means of the set pins J and the lock nuts K. The chuck body L is made from a good quality of cast steel, and should be carefully hardened and ground. The one in question is of the ordinary spring type, having four longitudinal saw slits as shown. The reduced screwed end L' should be left soft, the object being to make provision for finally securing it to the chuck plate F by means of the grub screw M; the drilling and tapping for the said screw being carried out while the two members are secured to each other.

Part N is the chuck cap or nut. This consists of a circular mild steel disc, having bored through the centre a hole of corresponding taper to that of the chuck nose. Its rear end is provided with a screwed hole of equal pitch and diameter to that of the chuck body as shown, and the locking and unlocking of the chuck is carried out by means of a "tommy peg" engaging with the radial holes N.'

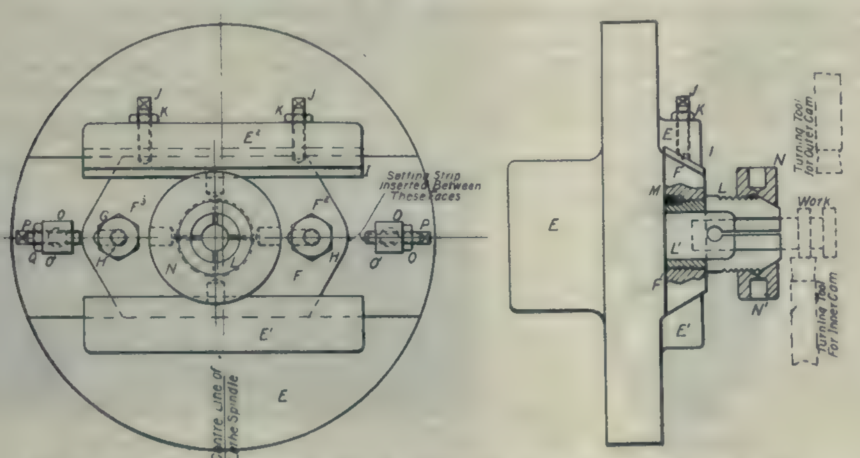


FIG. 6. FRONT AND END VIEW OF FIXTURE FOR THIRD OPERATION.

to the machine. It is further provided at its other extreme with a projection A² for the purpose of carrying the turning tool B, the latter being secured by means of the set screws C. Part D is the steady bush; This is made from a

Parts O. P and Q are the stop blocks, set pins and lock nuts respectively; the object of these being to give the two positive positions of the slide when in operation. The stop blocks O are made from square section mild steel, the ends being turned as shown at O.' and driven tightly into corresponding holes in the fixture body E. These blocks are also

provided with transverse tapped holes for receiving the set pin P. The sequence of operations of this fixture is as follows:—

The slide or chuck plate F is first set over until one of its ends is brought into contact with one of the set pins P. This is positively carried out by placing a setting strip (a block of mild steel correct to width) between the opposite end of the said plate and the adjoining set pin. The chuck plate is next secured in this position by means of the clamping nuts G. The strip is then removed and the work inserted in the

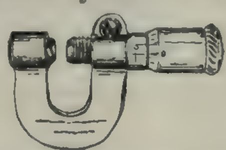
J. R. BROWN & SHARPE, 1872.

chuck ready for the first operation (turning outer cam).

The procedure for the second operation (turning inner cam) is identical with that of the first. The fixture is balanced by means of a detachable balance weight, this being arranged in any convenient manner to suit the exact requirement of the user.

CONCERNING BROWN & SHARPE MFG. CO.

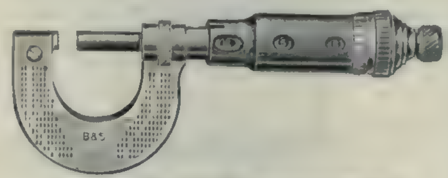
DAVID BROWN and his son Joseph R. founded at Providence, R.I., the business now conducted by the Brown & Sharpe



FORERUNNER OF MICROMETER CALIPER.

Mfg. Co. In 1841 the elder Brown retired and the son conducted the business alone until 1853, when with Lucian Sharpe he formed the partnership of J. R. Brown & Sharpe. The manufacture of steel rules and other precision tools was commenced in 1850. It was during this year that Joseph R. Brown built his linear dividing machine, and it is interesting to note that the original machine is still in use, capable of producing work meeting modern requirements for accuracy, although most of the company's work of this kind is done on machines of later design. Mr. Brown in 1851 brought out the vernier caliper.

Samuel Darling, in 1852, established a similar business in Bangor, Me., and the firm of Darling, Brown & Sharpe, in 1866, was the result of the consolidation of the two interests. One of the important achievements was the development of the micrometer caliper. In 1885 the improved micrometer caliper was put forth and since then its general design has been the same except for occasional improvements which have combined to



DIRECT READING MICROMETER.

make the present-day instrument accurate, serviceable and trustworthy.

The latest addition to the micrometer line, however, is a radical departure from its predecessors. The direct reading micrometer embodies entirely new features in design which make for convenience and elimination of errors in reading measurements. In stead of dimensions being calculated by graduations the size is indicated in plain figures at openings in the sleeve.

The American standard wire gauge was developed by Brown & Sharpe and was largely adopted by American wire manufacturers. Accurate gauges of the ring and plug styles and double and limit gauges were developed during the early sixties and in the early seventies were placed on the market.

The application of the vernier to the bevel protractor and later the introduction of a universal bevel protractor gave to the mechanical world tools of no mean value, while the addition of various other tools, and improvements and modifications of existing types to meet changing conditions, have always given the company an important position in this line.

The cutter business dates back to the invention of a universal milling machine and form cutters by Mr. Brown in 1861-64. Form cutters with teeth so relieved as to permit being sharpened without changing their cutting contour, marked a beginning in milling interchangeable parts, and greatly simplified

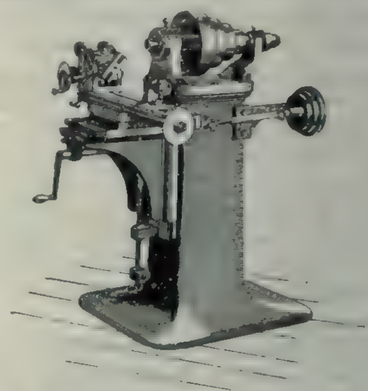
FORM CUTTER.

the problem of economically cutting accurate gear teeth.

B. & S. cutters are a recognized standard. A large department is now devoted to this branch of the business. Experts select the steel for these cutters and only material known by test and experience to be the best for the purpose passes inspection. Special machinery is used for cutting and relieving the teeth. Hardening and tempering are features receiving special attention. The large hardening plant is one of the most modern and best equipped on this continent.

Worthy of some attention is the machinery line manufactured. Over 100 different styles and sizes of machine tools are made. These include plain, universal and vertical spindle milling machines; universal and plain grinding machines; internal, surface and tool grinding machines; screw machines, automatic, semi-automatic and plain; and automatic gear cutting machines. Numerous attachments and accessories for these machines are made.

The factory has an aggregate floor space of 1,058,000 square feet. In 1872



AN EARLY UNIVERSAL MILLING MACHINE.

the total floor area was but 1,800 square feet. The buildings to-day are strictly modern and fireproof, and more than ordinary attention is paid to their up-keep. cleanliness and sanitary working conditions. In safety devices and means for safeguarding employees' health the company can be said to be the leader. An apprenticeship system is in operation which has turned out hundreds of capable mechanics and is regarded as an

B. & S. FACTORY TO-DAY.

ideal plan of industrial training. The employees have a mutual benefit association which has disbursed over $100,000 in benefits.

The Canadian Fairbanks-Morse Co., Montreal, Toronto, etc., are Brown & Sharpe representatives in Canada.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

LEVERS AND LEVERAGE.

OF all the machine elements, the lever is by far the most used. In fact, it appears in nearly every type of mechanism. Most elementary machines may be reduced to three classes, namely, the lever, the cord and the inclined plane. To the first class belong all arms, pulleys, gears, etc. The second class includes all machines in which force is transmitted by means of tensile members, flexible cords, bands, etc.; and the third class includes every machine that makes use of a hard surface inclined to the direction of motion, such as the wedge or screw.

A lever consists essentially of an inflexible rod or beam capable of motion about a fixed point. The three necessary points of a lever are:—(1)—The point about which it rotates, known as the fulcrum; (2)—the point at which the force is applied; and (3)—the point at which the load is taken. Levers are of three different classes:—(1)—That in which the fulcrum or pivot is between the load and the power; (2)—that in which the load is between the fulcrum and the power; (3)—that in which the power is between the work and the fulcrum.

The principle to be kept in mind in the consideration of all lever problems is that the load multiplied by its distance from the fulcrum is equal to the power multiplied by its distance from the fulcrum. Where several levers are used in series, such as in track scales, testing machines, etc., the arrangement is known as a compound lever, and is still subject to the above general rule.

* * *

Question.—A man who weighs 140 pounds desires to raise the edge of a casting weighing 3,640 pounds with a 49-inch bar. Where must he place the fulcrum so as to just balance the casting?

Answer.—Assuming that, by lifting one edge of the casting he would be lifting half the weight of the casting, the load becomes $\frac{3,600}{2} = 1,820$ pounds. The ratio of load to power is $\frac{1,820}{140} = 13$, or 1 to 13. That is, the load end must be 1 in length when power end is 13, or the total length of the bar must be 14. The actual length of the bar is 49 inches, and 1-14 of this, or the distance from the load to the fulcrum, is $\frac{49}{14} = 3\frac{1}{2}$ inches.

* * *

Question.—In the above problem, if the man had put the end of the bar under the casting an equal amount, what lifting force would he have to exert to accomplish the same end?

Answer.—Load multiplied by its distance is 1820×3.5, and the power arm of the lever, in this case, is its over-all length = 49 inches. Lifting force required is $\frac{1820 \times 3.5}{49} = 130$ pounds.

* * *

Question.—The force necessary to upset a $\frac{3}{4}$-inch rivet hot is 120,000 pounds. The rivet sets of a hydraulic riveter are 40 inches to the one side, and the toggle pins are 24 inches to the other side of the pivot pin. If the cylinder be 12 inches in diameter and the toggle give a reduction of 4 to 1, what hydraulic pressure would be required to do this work?

Answer.—Force required at the toggle pins is $\frac{120,000 \times 40}{24} = 200,000$ pounds. Area of 12-inch piston is $12 \times 12 \times .7854 = 113.1$ sq. ins. Actual force on piston required $= \frac{200,000}{4} = 50,000$ pounds. Pressure per square inch $= \frac{50,000}{113.1} = 442.08$. A pressure of about 500 pounds would be used for this work.

* * *

Question.—An air pump having a piston 10 inches in diameter is designed to work against a pressure of 15 pounds per square inch. The pump piston is operated from the end of a lever, the other end of which is pivoted to the engine frame, and the engine crosshead is attached at a point 12 inches from the pivot. If the total length of the lever be 32 inches, what force must be exerted upon it by the crosshead?

Answer.—Area of air pump piston is $10 \times 10 \times .7854 = 78.54$ sq. in. Total pressure upon air pump piston is $78.54 \times 15 = 1178.1$ pounds. The distance of air pump connection from the fulcrum is 32 inches, and the distance of the crosshead connection from the fulcrum is 12 inches. Force exerted by crosshead is, then, $\frac{1178.1 \times 32}{12} = 3141.6$ pounds.

* * *

Question.—In a differential chain hoist, the large sheave of which is 10 inches in diameter and the small one 8 inches, what weight on the hook would be equivalent to 60 pounds on the chain?

Answer.—The chain winds up on the 10-inch sheave and unwinds off the 8-inch. The difference between these two diameters is 2 inches. The radius of the 10-inch wheel represents the power arm of the lever and the radius of a 2-inch sheave represents the work arm, and the load that can be lifted is $\frac{5 \times 60}{1} = 300$ pounds. On account of the loop in the chain this forms practically half of the actual load. The load on the hook balanced by the pull of the chain, neglecting friction, is, therefore, $300 \times 2 = 600$ pounds.

* * *

Question.—A hydraulic elevator is operated by a piston 16 inches in diameter and 240 pounds per square inch of water pressure. There are two moving sheaves and two stationary sheaves, a single cable going to the car. What load can be lifted by the elevator?

Answer.—As the piston works against five cables, while the elevator is taken by one, the leverage ratio of the piston to elevator is 1 to 5. Area of piston $= 16 \times 16 \times .7854 = 201.06$ sq. ins. Total pressure on piston is $201.06 \times 240 = 48,254.4$ pounds. The load that can be lifted by the elevator, therefore, is $\frac{48,254.4}{5} = 9650.9$ pounds, or about $4\frac{1}{2}$ tons.

* * *

Question.—A hydraulic jack has a ram 2 inches in diameter and a plunger $\frac{1}{2}$-inch in diameter. It is operated by a lever 30 inches long, which is pivoted at the end, and is applied to the plunger two inches from the fulcrum. If a man is capable of exerting 120 pounds on the lever, what load could he lift with the jack?

Answer.—Area of ram is $2 \times 2 \times .7854 = 3.1416$ sq. in. Area of plunger is $.5 \times .5 \times .7854 = .19635$ sq. in. Ratio of ram to plunger is $\frac{3.1416}{.19635} = 16$ to 1.

Length of lever power arm is 30 inches. Length of work arm is 2 inches. Ratio of work to power is 15 to 1. Total ratio of work to power is $16\times15=240$ to 1. If 120 pounds be applied to the lever, the load lifted will be $120\times240=28,800$ pounds, or 14.4 tons.

* * *

Question.—Two shafts of equal size are connected by spur gears, the driver having 200 teeth and the driven 240 teeth. If the driven shaft become jammed and the power were sufficient, which shaft would most likely be broken?

Answer.—The radii of the gears are directly proportional to the number of teeth they contain. The ratio of the radii to each other is, therefore, 240 to 200, or 6 to 5. The driven shaft would, therefore, be first twisted off, and to be of equal strength the driven shaft should be one-sixth stronger.

* * *

Question.—A lathe is driven through double-back gears. Gears have 144 and 120 teeth, and corresponding pinions have 24 and 30 teeth. The pulley diameter is 16 inches and a double belt 4 inches wide is used. What cutting force could be secured at the tool when turning a pulley 24 inches in diameter?

Answer.—The effective pull of a belt in this position will be about 40 pounds per inch of width, and for a 4-inch pulley this becomes $40\times4=160$ pounds. The reduction in speed from the pulley to spindle is $\dfrac{120\times144}{30\times24}=24.$

The circumference of the driving pulley is $16\times16\times.7854=5.265$, and circumference of the pulley being turned is $24\times24\times.7854=75.398$ inches. The relative peripheral speed is, therefore, 24×50.265 to $1\times75.398=1206.36$ to 75.398, or 1 to 16.

The power multiplied by its distance equals work multiplied its distance, or force on tool $=\dfrac{160\times16}{1}=2,560$ pounds.

* * *

Question.—A hand punch is operated by a 6-foot lever. The load comes two inches from the end of the lever. What force on the lever would be required to punch a half-inch hole in ¼-inch plate.

Answer.—The shearing area of the hole is, circumference of hole $\times$ thickness of plate $=1.57\times0.25=.3925$ sq. in.

Shearing resistance of plate $=50,000$ pounds per square inch. Force required at punch is, therefore $\dfrac{50,000}{.3925}=12,378$

Length of lever is 72 inches. Leverage ratio is, therefore, 72 to 2, or 36 to 1.

Force on lever required is 344 pounds nearly.

THE GREAT ZEPPELIN FAILURE.

PROBABLY one of the greatest surprises of the present war, says a writer in the Liverpool Journal of Commerce, has been the futility of the much-vaunted Zeppelins of the Germans, as after the one or two record journeys made by these crafts, some considerable time before the war, it was anticipated in several quarters that their development would render them formidable weapons in the future.

A great deal of stress was laid upon these performances by certain parties with the intention of pressing our Government to pay more attention to, and, incidentally, to spend large sums of money upon these giant gas-bags, but, fortunately, the limitations imposed upon them by weather conditions and the necessity for having special sheds in which to house them were foreseen by the authorities, and only a relatively small sum was spent in building and experimenting with them.

Limitation Features.

Limitations imposed by the weather are usually interpreted by most people to mean the inability of these vessels to successfully combat gales and rapid changes of wind, but although this is a most important point, it is not more so than the loss of lifting power engendered by rain and snow storms. It has been pointed out on more than one occasion that the additional weight caused by the settling of rain on the envelope, and to a greater degree by the accumulation of snow, is a most serious matter for lighter than air machines, a rough approximation having shown that two or three tons of extra weight might easily be caused on an airship of about 500 feet in length.

It is interesting to learn that an expert has recently expressed the opinion that four tons of snow could lodge on the envelope of a Zeppelin, which at once shows the impossibility of ever building these machines so as to be independent of the weather. It is almost certain that four tons represents the weight of all bombs, ammunition, ballast, and portable stores carried by a present-day Zeppelin, so that in the event of one of these craft being caught in a snowstorm it must descend. This appears to have been exactly what happened to the two German dirigibles that were recently wrecked off the coast of Denmark.

A foreign report stated that the motors also failed at the same time that the storm was encountered, but as the coincidence is rather remarkable (snow in the atmosphere not being an adequate cause for the failure of an internal combustion engine), and the snowstorm, as shown above, is quite sufficient reason for their descent, it seems almost certain that it was the additional weight of the accumulation of snow which was the direct cause for the loss of these latest Zeppelins, as they are believed to have been.

It must not, however, be assumed that because of the great number of German airships that have been lost solely on account of weather conditions that Britain may not have a visit from them on some occasion during the present war. They have proved themselves capable of exceedingly long journeys under settled barometric conditions, and it is safe to say that the remaining Zeppelins will be very carefully nursed for the remainder of the winter, with the object of giving some return for the money spent upon them when the summer is again with us.

The Aeroplane Success.

Now that the Kaiser's experts have learnt by bitter experience that they have "backed the wrong horse" by expending such enormous sums of money on these delicate craft, it is in the highest degree probable that the Germans will not proceed with the construction of any more new machines for war purposes, especially bearing in mind the fact that their essential "resting places" are so easily destroyed by daring aviators, as was the case in the Dusseldorf and Friedrickshaven raids. We have, however, gained the enormous advantage that these sums of money already expended on them were not spent in aeroplanes, which have proved themselves such valuable additions to our army and navy, mainly through the instrumentalwity and foresight of Mr. Churchill in insisting on the rapid development of this arm of the services. The extraordinary feats performed by our aviators and the thorough reliability of the machines themselves prove that the course of the war must be profoundly influenced by this policy, and we should be eternally thankful to our Government Departments that while Germany was wasting huge sums of money on her gas-bags we were busy preparing the most efficient Royal Flying Corps.

Canadian Pig Iron in 1914.—According to a preliminary report just issued by the Department of Mines, Ottawa, the production of pig iron in Canada in the calendar year 1914 fell over 30 per cent. compared with 1913. The total was 783,164 net tons, which is the smallest since 1909. Of this 9,380 tons was made with charcoal and 773,784 tons with coke. Based on an estimate of $12.77 per ton at furnace, the value is placed at $10,002,856. The classification of production, according to the purpose for which it was intended was: Bessemer, 230,817 tons; basic, 346,553 tons; foundry and malleable, 205,794 tons.

PROGRESS IN NEW EQUIPMENT

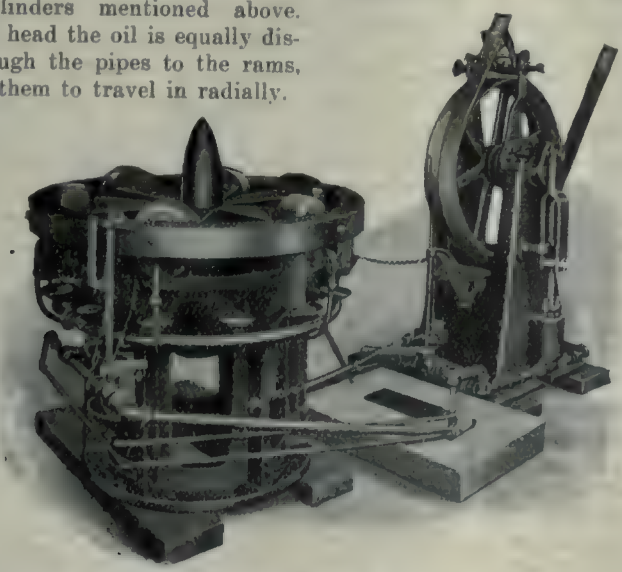
A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

HYDRAULIC SHELL-BANDING MACHINE.

THE hydraulic compressing machine here described and illustrated is a product of the West Tire Setter Co., Rochester, N.Y. It is specially adapted to the compressing of the copper bands on to shrapnel shells and other projectiles, and consists of a cast iron base in the form of a circle, on to which is mounted a 36-in. inside diameter steel ring. Inside of this ring are placed six rams or cylinders, equally spaced. These, when pressure is applied, are caused to travel radially toward the centre of the machine.

Against the faces of the rams are placed six V-shaped dies or blocks, which take a bearing against the outside of the band, and press it home in the groove as the rams travel towards the centre of the machine. These blocks or dies are carefully machined to the proper circle and form to press the band, and also spread it to fill the groove in the shell, means being provided for holding the bands at just the right height to enter the groove, the shell being held in a vertical position.

Oil is used as a pressure medium, it being forced into the machine by means of a belt-driven power pump, which draws the oil from the oil tank and carries it to the centre of the base of the press, where is located an oil head, from which pipes are run to each of the six rams or cylinders mentioned above. From this oil head the oil is equally distributed through the pipes to the rams, thus causing them to travel in radially.



HYDRAULIC SHELL BANDING MACHINE.

The amount of pressure required for the compressing of these copper bands depends largely upon the width and thickness of the band and the amount it must be spread to fill width of groove, rather than upon the diameter of the shell. This machine, however, is capable of giving 30 tons pressure on each of the six rams, or a combined pressure of 180 tons, and this is sufficient to compress any of the ordinary copper bands on shrapnel shells.

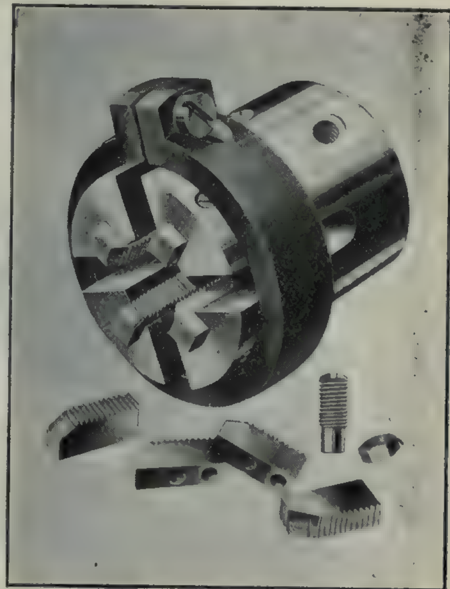
The machine is capable of compressing at least two bands per minute, depending largely, of course, upon the operator and also to the other facilities for handling. By changing the dies the machine can be adapted to any diameter of shell within its capacity.

This product is one of a large line of compressing machines built by the West Tire Setter Co., and we are advised that they are now building for shipment a tire-setting machine for compressing cold steel tires 12 ins. wide by 1⅜ ins. thick, ranging in various diameters up to 6 ft., and we understand that they have built machines for handling tires over 9 ft. in diameter. Machines to Canadian order are built in Hamilton, Ont.

PIPE-THREADING DIE FOR SCREW MACHINES.

A NEW die for producing pipe threads on hand and automatic screw machines, turret lathes, etc., has recently been brought out by the National Acme Mfg. Co., Cleveland, Ohio, and Montreal, Canada. The die is not intended to supplant the special forms now in use upon pipe machines or more elaborate tools used for threading attachments and pipe fittings. These dies are made on the spring principle, and furnish many marked improvements over the older forms of such tools.

The body is made of a special steel and is milled into four prongs like the regular spring die. These prongs are broached to receive chasers which extend back into the body only far enough to accommodate the longest pipe thread likely to be cut. They are fastened to the body by screws and dowel pins in such a way that they may be easily removed for sharpening or replacement.



ACME PIPE DIE, SHOWING PARTS.

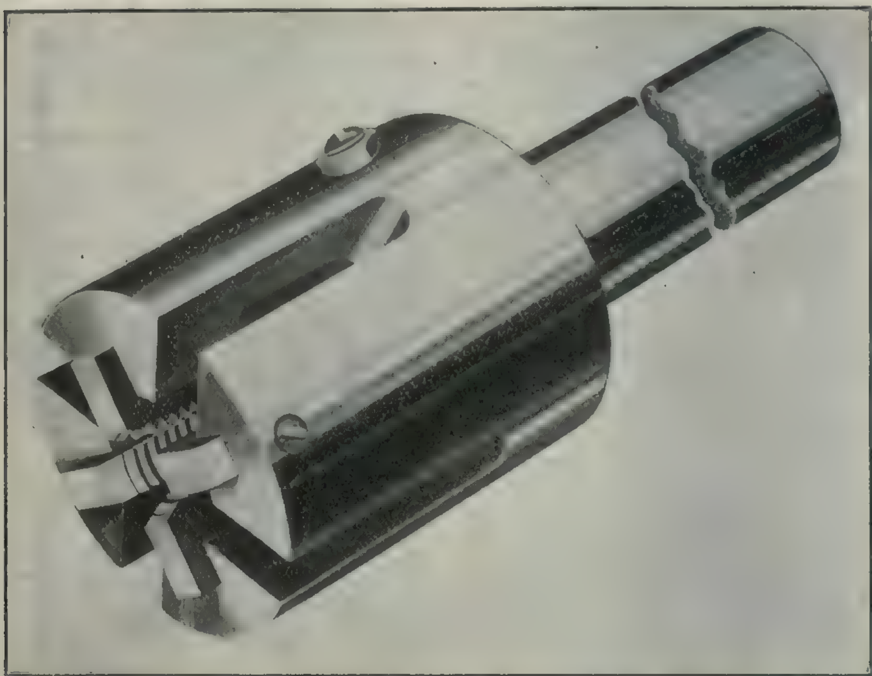
This arrangement gives a very heavy body, with plenty of chip room, space for lubricant, and other essentials of free cutting. The stiffness of the prongs would probably limit the adjustment possible by means of the collar. This, however, could be easily overcome by judicious shimming if such a variation were required. The addition of weight and strength to the body part which is required to resist severe cutting strains is no doubt a great advantage.

The chasers for these dies are accurately hobbed and cleared to cut freely. Being in small pieces, they are much more easily hardened with uniformity than are the cutting lands of a solid die, thus obtaining the advantages of opening and closing dies in this respect. The clamping collar is fitted with four suitable bearing surfaces to place the closing effect most suitably upon the prongs.

Shanks are furnished rough or finished to fit the turret hole of any machine. The large or die end of the shank has a

free fit in the die body to allow the die to centre itself on slightly uneven work. This floating effect is said to greatly increase the lasting qualities of the chasers. A heavy dog-point screw passing through the die body into the shank and held by a countersunk hexagon nut furnishes the drive between the body and the nut.

Each outfit includes one set of dies, one clamp collar, and one shank fitted to the die body.



ACME PIPE DIE ASSEMBLED.

CONCERNING A BURST FLYWHEEL.

WRITING in the Vulcan of March, F. O. Beckett gives an interesting account of how a flywheel burst a few years ago in a works at Sheffield. It appears that the pin holding the valve to the spindle of the boiler stop valve had been replaced by a common 5-16 in. bolt, instead of a properly fitted pin, and owing to heavy vibration the nut worked off and the bolt fell out. The bolt, of course, soon found its way along the steam pipe and jammed in the double beat throttle valve.

The engine was direct coupled to a rolling mill, and, as soon as the load went off, the governor became inoperative in consequence of the throttle valve being fouled. As soon as the engineer-in-charge saw the speed of the engine increasing, he threw off the governor belt and tried to close the throttle by hand; failing in this, he ran to the boiler stop valves, but whilst closing No. 1 valve the flywheel burst and completely wrecked the engine.

One piece of the rim went through the roof and struck the flange of the dome crown of one of the boilers, indented the plate, but fortunately did no further damage. Another piece cleared the works, crossed the River Don, and buried itself—some say 6 feet deep—at the door of a cottage, from which, at the moment, by a strange coincidence, a funeral procession was emerging. Fortunately this piece also did not cause personal injury.

ROTARY AIR PUMPS.

AT a recent meeting of the Junior Institution of Engineers, A. Arnold, in a paper on "Rotary Air-Pumps," gave a good description of the Worthington hydraulic vacuum pump, the "Kinetic," the Leblanc, the Rees Roturbo, the Wheeler or A.E.G., and the Willans Muller air-pumps, in which, he said, the evolution of the rotary air-pump is a natural outcome of progress in other directions, particularly the perfection of the steam-turbine, and its employment in cases in which the highest efficiency is required. The simplest rotary air-pump is, perhaps, the ejector condenser, which has the advantage of being its own condenser. The essence of the trouble with the ejector condenser is to get the water to entrain the air effectively. If the water-jet could be split up into little parcels, and entrap a plug of air between successive parcels, it would be much more effective, and this is the idea from which the Leblanc air-pump has been evolved.

In the Rees Roturbo rotary air-pump the injector water is mechanically controlled both at injector and discharge from the vacuum space, and the risk of the ejector "choking," and breaking the vacuum, is eliminated. The difficulty of inducing the water to entrain a reasonable volume of air is solved in the Worthington hydraulic vacuum pump by a helical form of jet, produced by the action of the water in an ejector upon a peculiarly-shaped gun-metal wheel.

SUPPLEMENTARY ESTIMATES.

SUPPLEMENTARY estimates for the current year were tabled in the House by the Minister of Finance on Saturday, March 27, amounting to $4,364,541. This includes $2,616,999.90 chargeable to consolidated fund account, $1,538,845 chargeable to capital, and $208,695.63 for unprovided terms.

The items include $300,000 for the new Halifax terminals, $832,845 for the Transcontinental Railway, $350,000 for the Hudson Bay Railway, $30,000 for the Welland Canal, $101,636.50, part subsidy to the Canadian Vickers for the construction of the Montreal ship dry-dock, $10,000 for the relief of destitute Indians in Ontario and Quebec, $18,900 for more seed grain for the Prairie Provinces, $29,900 for destitute Indians in the Prairie Provinces and North-West Territories, $10,000 for destitute Indians in British Columbia, $10,000 for the relief of destitute Indians generally, $10,000 in connection with the smallpox epidemic, $50,000 for the relief of sufferers in the Hillcrest colliery disaster, $13,000 for the expenses of the Acting High Commissioner in London, $16,500 to widows and other dependents of the crew of the lost Government steamer Sharon, $365,000 for land mail service, $300,000 for railway mail service, $105,000 for rural mail boxes, and $5,000 to the Canadian Import Company for the recovery of mails from the Empress of Ireland.

SOLDER TO MELT AT 160° F.

W. J. A. asks for the constituent parts of a solder that will melt at a temperature of 160 degrees F., also how much of each of the various materials would be required to make a certain quantity, together with the total cost. The following will, it is hoped, furnish the data called for in the query:

Solder to Fuse at 160° F.

	Per 100 lb.	Cost per lb.
Cadmium	15.4	$3.00
Bismuth	38.4	4.50
Lead	30.8	0.06
Tin	15.4	0.57
	100.0	$8.13

This works out at about $2.30 per lb. Although not absolutely certain, we believe that the Canada Metal Co., Toronto, can make up such a solder and are in a position to retail it at something like $2 per pound.—Edwin Newsome.

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Vol. XIII. APRIL 1, 1915 No. 13

PRINCIPAL CONTENTS.

A PLEA FOR PATRIOTISM.

WE had the pleasure of hearing Sir George Foster, Canadian Minister of Trade and Commerce address Ward Three Conservative Association, Toronto, last Friday evening. His subject of patriotism was too big and too important, and his heart too sincere about it for even a streak of politics to enter. Further, the eloquent and masterly, yet appealing manner with which he handled it, left no doubt on the minds of those present that he at least is not one of our "boat rockers," otherwise our self-seekers. Patriotism, he made very clear, meant sacrifice, and not its present-day substitute—skilfully masked service to our individual profit.

Since this European War started there has been a woeful absence of that patriotism of which Sir George spoke in our business and public life, particularly with respect to the circumstances which bring these into touch with each other. Unsavory revelations and disclosures are becoming an almost every-day occurrence relative to outfitting our various overseas contingents, and we are somewhat suspicious that conditions may yet become sufficiently intolerable in the matter of munitions of war manufacture to Allies order, to break cover.

We are just sufficiently lacking in that patriotism which Sir George Foster so masterly propounded as to have become impatient to know—not what Canada is going to get out of this European War, but what we—you and I are going to get out of it. What we are going to put into it of service and sacrifice is to all appearance the very last thing thought of. Hence, in the full knowledge of hardship and suffering and barrenness of opportunity of those who have placed their lives at our Empire's disposal, there is abundant evidence that too many of us are almost wholly and unreservedly "on the make."

"This war will sadden us," said Sir George, "but it will make us a more serious people. It will teach us that there is something more to live for than business, speculation and pleasure; it will teach us to look back on the past; teach us that the liberties given to us were given to keep and pass on. Our work is never done. Our duty is self-denial, self-sacrifice, the laying down of life blood for immeasurably deeper and greater things: for things that make for national and Imperial life."

It is painfully evident that we have not yet reached the "serious" stage, much less that which will be saddening, and, while disclaiming even a trace of natural tendency to pessimism, we are convinced that both the serious and saddening stages will materialize in our midst before the clash of arms in Europe ceases.

It is encouraging, yes and refreshing to have a public man step out even once in a while, if for no other purpose than to expose the hollowness and mediocre accomplishments of those with whom he is associated. Similar action on the part of a business man is likewise encouraging and refreshing. In either case it goes to show that politics or business constitute as they should, only a part of the being of each.

Of such rare occurrences, however, are these experiences, that we come to look upon them as a species of freak. We are so accustomed to speak of so-and-so as a successful politician, and somebody else as a successful business man that we unthinkingly—in many cases truthfully perhaps, so credit them as regards every feature of their being.

Sir George Foster has amply proved that being born a man, and while incidentally a politician and Canada's Minister of Trade and Commerce, he is living and acting as a man. Politics is one of his side lines, just as law, engineering, journalism, teaching, etc., should be reckoned as our side lines. The trouble with too many of us is that although born men, we live by our wits, and at the end of life's thread pass out on our own judgment as fools.

If we lack patriotism, we are bound to be lacking in straight up-and-down every-day honesty, and if Sir George's appeal for the former bears the fruit it deserves, then with respect to the latter, Canada's public and business life will for the future be surrounded by a more wholesome atmosphere.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 9 50	$10 00
Copper, crucible	11 00	11 50
Copper, unch-bled, heavy	11 00	11 50
Copper, wire, unch-bled	11 00	11 50
No. 1 machine compos'n	9 50	10 00
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 00	9 50
No. 1 brass turnings	7 00	7 25
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal
Standard				
¼, ⅜ in.	64	47	....	....
½ in.	69	56	....	....
¾ to 1½ in.	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in.	74	61	73	60
4½, 5, 6 in.	....	....	72	59
7, 8, 10 in.	....	....	68	56
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	41	....	....
½ in.	63	50	....	....
¾ to 1½ in.	68	55	....	....
2 in.	68	55	64	51
2 , 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in.	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto
Lake copper, carload	$26 75	$16 75
Electrolytic copper	16 50	16 50
Castings copper	16 25	16 25
Tin	56 00	54 00
Spelter	12 00	12 00
Lead	5 50	5 75
Antimony	22 00	25 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh.	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70

Miscellaneous wire nails... 75 per cent.
Pressed spikes, ⅝ diam., 100 lbs. 2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong Size Ins.	D. Ex. Strong Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 100-lb. kegs, per cwt	6.75
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.69
Linseed oil, raw, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch.	$8.00
5/16 inch	5.35
⅜ inch	4.60
7/16 inch	4.30
½ inch	4.05
9/16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. galvanized)	4 50	4 50
Queen's Head, 28 B.W.G.	4 60	4 60
Fleur-de-Lis, 28 B.W.G.	4 30	4 30
Gorbal's Best, No. 28	4 60	4 60
Viking metal, No. 28	4 20	4 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., March 29, 1915.—Industrial conditions during the last week have been much as usual. No events of note have transpired outside of those which are directly or indirectly connected with the shell business. Large orders of shells from the Russian Government have been received, and, on account of these orders, certain lines of machine tools have been exceptionally active. Pig iron has not moved to any extent nor is there much likelihood of any change in the immediate future. Copper is a little stiffer in price, and the price of tin has dropped a little, owing to the supply in New York being a little easier.

The Steel Trade.

The steel trade is rather quiet as far as railway supplies are concerned. It is officially announced by the Canadian Car & Foundry Co. that their recent order from the Russian Government is considerably in excess of thirty million dollars, which amount was mentioned in the local papers. It is also understood that the delivery must be made within ten months. The forging plant from the Western plant has been removed to Montreal and active arrangements are being made to start immediately on this work. Of course, the Canadian plant, vast as it is, cannot commence to handle

this work alone. Portions of the contract will be sub-let both in Canada and the United States.

The Hull Steel and Iron Foundry have recently installed in their new shops a steel converter of Belgian manufacture, and are able to make steel castings up to several tons in weight. Castings of steel to any analysis can be obtained and there is no doubt that this firm will make a big bid for work in the future. The Algoma Steel Co. expect to start up their merchant bar mill about April 1st. This mill has not been running for some time.

Pig Iron.

Pig iron is not moving in any volume, the little business done being of the hand-to-mouth variety. Prices remain much the same.

Machine Tools and Supplies.

The impetus created in the turret lathe and small machine tool trade has been again stimulated by the placing of new orders for shells. With more determination than ever, dealers and manufacturers are endeavoring to meet the increased demand. Attachments and tools for standard machine tools make a strong showing on the market, and many ingenious methods and devices have been unearthed in a remarkably short period of time.

The supply business is increasing daily and the quality of supplies is of the very best, hence this business is one that cannot be overlooked.

Metals.

Contrary to expectations, the price of copper has gone up slightly. From all quarters a decline was expected. The tin situation is easier. British shipments from London have had a tendency to make matters better in New York. Lead is a trifle stiffer. The scarcity of antimony has made itself evident again by the increase in price of one cent a pound. Aluminum is unchanged. Canadian prices are all higher than American owing to the war tax and difficulty of financing.

Toronto, Ont., March 30, 1915.—A better feeling is noticeable in business circles, and confidence is gradually returning. Although the volume of trade is by no means normal, it is very fair, considering the prevailing conditions. One desirable feature about the present industrial depression is the effect which it has had in eliminating, to a great extent, speculation. It has also proved the necessity of a more careful management of commercial undertakings. Conservation of capital is essential under present financial conditions, although money is not as tight as it was at the beginning of the year. The majority of engineering works are actively engaged in the production of shells or parts of shells, and but for this, many plants would be practicalyy idle. Good progress is being made in this special industry, and the firms interested are rapidly adapting themselves to the new class of work. The output of shells is increasing each week, and with a practically unlimited demand, production should soon reach a high figure.

Steel Market.

Conditions in the steel trade are gradually improving, although business is not very brisk. The building trade is showing very little improvement, notwithstanding the fact that the season is now sufficiently advanced to permit of greater activity in operations. A few specifications for steel pipe for waterworks systems have been issued, and there is a better movement in structural shapes for bridges. The demand for round bars for lyddite shells is increasing, and some nice business is anticipated, as the plants for making these shells become equipped. The only price change to note this week is in cold drawn steel shafting. A new list has been issued, and the discount is now 40 per cent. at mill or warehouse. Quotations on steel products are firm.

Sentiment is improving in the States, and the volume of business is increasing. The heavy demands for rounds for shells for the Allies has caused considerable strength in the steel bar market. All markets are firm.

Pig Iron.

There is nothing of particular importance to note in the pig iron market. The demand continues light and quotations unchanged.

Scrap Metals.

The market is dull, with light demand. Quotations are unchanged, but firm.

Machine Tools.

Considerable activity continues in the market, and the demand for tools is almost entirely for shell-making equipments. The demand for machines for this purpose is so heavy that great difficulty is being experienced in obtaining satisfactory deliveries. Several United States' concerns have booked large orders from the Allies for shell machinery, and as some of these firms are also selling tools in this market, deliveries are naturally affected.

Supplies.

The supply business continues to improve and the market is steady. Prices are firm and unchanged except for linseed oil, which has declined 4c, due to a break in the flax seed market.

Metals.

Business is steadily improving, but consumers are cautious and buying in small lots. The markets have a weaker tendency. tin and spelter having declined; in both cases, however, quotations are more or less nominal. Other markets are quiet, but firm.

Copper.

The copper situation is unchanged and the British Government has practical control of all shipments of this metal from the United States to Europe. The market is quiet, but firm, and quotations are unchanged.

Tin.

The market is recovering after a heavy decline in London, but business is dull. The congestion at the London docks and scarcity of shipping is an important factor in the situation, and there is no relief in sight. The market is weak and quotations have declined to 54c, which is more or less nominal.

Spelter.

The market is stagnant and very irregular. The situation has not improved with regard to obtaining prompt shipment. Spelter quotations are nominal at 13c per pound.

Lead.

The market is quiet, but very strong, with a possibility of higher prices. Quotations are unchanged at 5¾c per pound.

Antimony.

The market continues quiet at unchanged prices. Quotations are nominal and unchanged at 25c per pound.

Aluminum.

There is no change in prices, which are firm at 23½c per pound.

Transformer and Switch Oils.—Transformer and switch oils are very little understood by the average engineer, states the Vulcan, and many of the heating troubles experienced are due, not to the apparatus, but to the oil, as a very small amount of adulteration may cause trouble. Moisture, even to the extent of five or six drops of water per quart of oil, reduces the insulation by about 25 per cent. Sulphur, resin, acid and alkali, which are found in some oils, also have a very bad effect, while the formation of carbon and sludge takes place even in the best oil. The way to avoid these troubles is to buy the oil to strict specification, and to have it properly tested before use. Tests at frequent intervals should also be made, while the tanks should be cleaned out at least once every year, and the oil changed, or at least filtered, at the time.

THE reason so few people get what they want is because they don't want it hard enough to use real effort in bringing things their way.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Thorold, Ont.—The Beaver Board Co. propose to buy additional equipment for the power plant.

St. John, N.B.—Messrs. Eagles, Hogan & Sterling, all of this city, will establish a brass foundry here.

Seaforth, Ont. — The Bell Engine Works has received a contract from the Government for the manufacture of shells.

Moncton, N.B.—The Record Foundry and Machine Co. has received an order for lyddite shells from the Shell Committee.

Winnipeg, Man.—A by-law is being considered by the City Council to raise $35,000 for establishing a municipal machine shop.

Sarnia, Ont.—The Sarnia Metal Products Co., which has recently completed its plant, will start operations in a few days. Lloyd Lott is sales manager.

Charlottetown, P.E I.—The foundry and blacksmith shop of the Bruce Stewart Co., were destroyed by fire on March 20. The damage to the buildings and machinery is estimated at $10,000 with $5,000 insurance.

Tara, Ont.—John S. Clark, of Paisley, has gone into partnership with John Foster, of Walkerton, and purchased the Gerolamy foundry in Tara. Mr. Clark was formerly with the Goldie & McCulloch Co., of Galt.

St. Thomas, Ont.—M. R. Bump, chief engineer of the Southern Ontario Gas Co., recently made a report to the head officers, with respect to the installation of a purification plant for Tilbury natural gas at Glenwood. Mr. Bump points out in the letter that the results obtained have been very gratifying, and he believed that they are now in possession of the necessary information to enable them to complete a plant with sufficient capacity to handle all of the gas necessary to supply the needs of the company.

Hamilton, Ont.—The Franklin Steel Works of Joliet, Ill., has decided to locate a branch factory in Hamilton for the manufacture of toe calks for horse shoes. Incorporation has been applied for with a capital stock of $40,000, the new concern to be known as the Franklin Steel Works, Ltd. A factory that formerly was part of the old plant of the Laidlaw Bale Tie Co. has been leased. W. F. Pitcher, of the Franklin Steel Works, Joliet, Ill., will be treasurer and manager of the Hamilton branch.

Electrical

Toronto, Ont.—The Board of Control will purchase 6,000 hydro lamps.

Toronto, Ont.—The Toronto hydro-electric will purchase a number of new type lamps for the city bridges.

Victoria, B.C.—The City Council propose to install a fire alarm system at an estimated cost of $12,500. Clerk, W. J. Dowler.

Sarnia, Ont.—Engineers Jeffrey and Lawlor, of the Hydro Commission, have arrived here and have commenced collecting data necessary to make estimates of the cost of a distributing system for Sarnia. An effort is being made to get the Sarnia Electric Company to work with the Commission's engineers in making a valuation of their system.

Municipal

Welland, Ont.—The council has voted $25,000 for the Welland Hydro Commission.

Galt, Ont.—The by-law to raise $11,000 for a fire alarm system was defeated on March 26.

Trenton, Ont.—Extensions are contemplated to the waterworks distribution system.

Quebec, Que.—The City Council is contemplating extensions to the waterworks system.

Toronto, Ont.—The city has obtained the necessary power to spend $12,000 on waterworks improvements.

Huntsville, Ont.—A by-law is contemplated to raise $12,000 for a new firehall and electric light equipment.

Berlin, Ont.—A by-law to raise $6,000 for water extensions is contemplated by the Water and Light Commission.

Transcona, Man.—Tenders will be called shortly for two 6-in. centrifugal sewage pumps. Engineer, W. M. Scott, Winnipeg.

Toronto, Ont.—The city has obtained power from the Provincial Legislature to spend $70,000 for the Strachan Ave. bridge, and $11,000 for a bridge at Crawford street.

Toronto, Ont.—The Street Commissioner has recommended that the Canadian Griscom-Russell Co., Montreal, be awarded the contract at $49,200 for a Sterling incinerator.

Chatham, Ont.—The city engineer has submitted a plan and estimate of the sewage disposal system. The report has been referred to the Provincial Board of Health for their approval.

Bracebridge, Ont.—The following by-laws will be voted on by the ratepayers on April 12: $4,000 for new pumps; $2,700 for water main extensions; $5,300 for waterworks extensions.

Toronto, Ont.—The Board of Control has decided to purchase additional apparatus, including an aerial truck, combination chemical and hose wagon and two motor trucks for the fire department.

Peterborough, Ont.—The City Council will enter an appeal against the Board of Arbitrators' award of $154,615 as the price the city shall pay for expropriating the Peterborough Light & Power Co. plant.

Mimico, Ont.—Aird Murray & Lowes, engineers of Toronto, will inspect the New Toronto water system, estimate the cost of a connection with Mimico and ascertain if the system is capable of supplying this town.

Walkerton, Ont.—Two by-laws will be voted on by the ratepayers on April 15. The first is to raise the sum of $3,500 for the construction of the 100-foot span to the west end bridge, and the second to raise the sum of $5,000 to extend the waterworks system.

Toronto, Ont.—Mayor Church announced last Monday that the new civic car lines on Lansdowne avenue and Mount Pleasant road would be started as soon as the frost is out of the ground. More cars and equipment for civic lines, to cost $100,000, are to be secured.

Montreal, Que.—The City Council has refused to vote $250,000 for the construction of the municipal library before they are made acquainted with the material to be used in the building, the

name of the contractor, etc. The building will cost, if the lowest tender is accepted, $466,000.

Brockville, Ont. — The recommendations of the joint civic committees for the improvement of Brockville's water supply will be forwarded to the Provincial Board of Health for approval, and if found satisfactory steps will be taken for the immediate installation of a filtration plant at the pumping station. It is proposed also to extend the intake pipe and divert the sewage outlet so that it will not contaminate the water supply.

General Industrial

Owen Sound, Ont.—The McQuay Tanning Co. will build an addition to their plant.

Coatsworth, Ont. — The Coatsworth Brick and Tile Co. will probably make extensions to their plant.

Winnipeg, Man.—It is reported that a factory to manufacture "cream of wheat" will be established here by a Minneapolis concern.

Ingersoll, Ont.—It is announced that the Borden Condensed Milk Co. will make additions to their plant costing $60,000. R. B. Hutt is superintendent.

Lindsay, Ont.—An effort is being made to amalgamate the Lindsay Office Fittings Co., with the Capital Office Supply Co., of Ottawa. Peter Kennedy, of Lindsay, is interested in the deal.

Lindsay, Ont.—Plans have been prepared for a new factory for Horn Bros. Woolen Co. It is stated that the building will cost over $45,000 and the machinery $55,000. The old factory was destroyed by fire some time ago.

Contracts Awarded

Granby, Que.—The Imperial Tobacco Co. has awarded a number of contracts for the new powerhouse to be erected here.

Toronto, Ont.—The Board of Education has awarded a contract for electrical fixtures for the new Technical School to Keith's Ltd., of Toronto. The contract amounts to $9,960.

The Pas, Man.—The contract for the steel cantilever across the Nelson River, at Manitou Rapids, on the Hudson Bay Railway, has been let to the Canadian Bridge Co., Walkerville, Ont.

Calgary, Alta.—Contracts have been awarded for storage battery materials in part to the Canadian General Electric Co., for $2,058.66, and in part to General Supply Co., Ottawa, for $550.

Ottawa, Ont.—The City Council have awarded the contract for the supply of 12-in. water-mains to the National Iron Works, Ltd., Toronto.

Saanich, B.C.—At a meeting of the city council held recently the contract for the supply of cast iron piping and special castings was given to Balfour, Guthrie & Co. The tender of Balfour, Guthrie & Co. quoted prices of $36.81 per ton for the piping, and $74.29 per ton for the special castings, making the amount of the contracts $139,841 and $9,060 resepectively.

Toronto, Ont.—The Board of Education has awarded the following additional contracts for equipment at the new Technical School: Forge fan to the Canadian Sirocco Co., Windsor, Ont., for $877; laboratory switchboards to the Canadian Westinghouse Co., Hamilton, for $1,315; lockers to the Dennis Wire & Iron Goods Co., London, Ont., for $4,050; printing presses to the Toronto Type Foundry Co., Toronto, for $4,200.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British—Col. A. G. Barton and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Tenders

Hamilton, Ont.—Tenders will be received by the Board of Control, up to Tuesday, April 6th, 1915, for the following:—520 feet of reinforced concrete pipe, 4 feet 6 in. diameter; 540 feet of reinforced concrete pipe, 4 feet 3 in. diameter; 495 feet of reinforced concrete pipe, 3 feet 3 in. diameter; 600 feet of reinforced concrete pipe, 2 feet 6 in. diameter, for the construction of a sewer on Gertrude Street; also for 770 feet of reinforced concrete pipe, 2 feet 6 in. diameter, for the construction of a sewer on Burlington Street. Specifications and form of tender may be had upon application to A. F. Macallum, C.E., city engineer.

New Incorporations

The Inland Power and Traction Co. of Fort George, B.C., has been incorporated with a capital of $25,000.

The Gas City Brick Co. has been incorporated with a capital of $300,000 to carry on business at Medicine Hat, Alta.

The Doone Tractor Co. has been incorporated with a capital of $40,000 to carry on business at Winnipeg, Man. Incorporators: J. H. Green, E. R. Chapman and F. L. Quance of Winnipeg.

Beaver Mica Mining Co. has been incorporated at Ottawa, Ont., with a capital of $50,000 to develop mines, minerals and manufacture mica, etc., at Ottawa, Ont. Incorporators: P. H. Chabot, A. J. O'Brien and F. W. Ward, all of Ottawa, Ont.

The Canadian Regal Motor Co. has been incorporated at Toronto, Ont., with a capital of $100,000 to carry on the business of manufacturers of automobiles, etc., at Berlin, Ont. Incorporators: H. Nyberg, A. H. Millar and L. K. DeBus, all of Berlin, Ont.

Kelly, Powell, Ltd., has been incorporated at Ottawa, Ont., with a capital of $50,000 to manufacture railway contractors' mining and municipal supplies at Winnipeg, Man. Incorporators: J. T. Kelly, E. G. Powell, of Winnipeg, Man., and H. J. Trihey, of Montreal, Que.

The Canadian Blower & Forge Co. has been incorporated at Ottawa, Ont., with a capital of $500,000 to manufacture heating, ventilating and drying apparatus, fans, etc., at Berlin, Ont. Incorporators: W. F. Wendt, H. W. Wendt and J. M. Chipman, all of Buffalo, N.Y.

Rubber Regenerating Co. of Canada, Ltd., has been incorporated at Ottawa, Ont., with a capital of $200,000 to regenerate and reclaim rubber and rubber by-products at Montreal, Que. Incorporators: C. Macpherson Holt, E. M. McDougall and G. S. Stairs, all of Montreal, Que.

Personal

Alexander Kirkaldy has been appointed chief engineer for the new Technical School at Toronto, by the Board of Education.

H. A. Bayfield has been appointed by the Dominion Government to the position of principal assistant engineer at the Fort Nelson terminus of the Hudson Bay Railway.

A. J. Somerville, for some time president of the Ontario Lead and Wire Co., died at Toronto on March 28. Mr. Somerville was born at Huntington, Que., in 1844, and came to Toronto some 40 years ago.

Charles J. Phoenix, assistant to W. D. Muir, manager of the steel department of the Steel Company of Canada, Ltd., Hamilton, has left to join the staff of the Algoma Steel Corporation, Sault Ste. Marie, Ont.

Richard James, who for the past few years has been the Montreal manager of Beauchemin & Fils, Ltd., manufacturers of steel castings, has severed his connection with that firm and will in future act as a manufacturers' agent dealing in iron and steel castings, machinery, foundry and power supplies. His address is 55 Cote street, Montreal.

Jabez G. Twiton, secretary-treasurer of the Australasian branch of the Massey-Harris Co., of Toronto, died March 18, at Melbourne, Australia, from injuries received in a motor accident. He was 62. He entered the service of the Massey-Harris Co. in 1884, and five years later was transferred to Melbourne to take charge of the company's Australian business.

Frederick Winslow Taylor, a well known engineer, died at Germanstown, Pa., on March 21, aged 59 years. The late Mr. Taylor was the pioneer of scientific shop management and methods, and he devoted the greater part of his career to the study and application of his theories. His work has been of a far-reaching character, and has revolutionized factory management. Mr. Taylor collaborated with Maunsel White in the discovery of the Taylor-White process of heat treatment.

Alex. Taylor, of Toronto, formerly assistant secretary, has been appointed secretary of the Lake Superior Corporation, the Algoma Steel Corporation, and the subsidiaries of these concerns. Mr. Taylor succeeds Thomas Gibson, who recently resigned, and is now president of the Lake Superior Corporation, succeeding Mr. Frater Taylor of Sault Ste. Marie, who, however, retains the presidency of the Algoma Steel. Mr. Taylor has also been added to the board of the Lake Superior Corporation.

Trade Gossip

Darling Bros., Ltd., Montreal, have been awarded the contract for the installation of elevators in the Martin Senour Paint Co.'s factory.

Lecky & Collis, Ltd., of Montreal, have been appointed sole agents for eastern Canada for the hoisting engines, etc., manufactured by the Doty Marine Engine and Boiler Co.

The Otis-Fensom Elevator Co., Hamilton, has been awarded contracts for the elevators at the Immigration Building, Vancouver, B.C., and the Customs House at Port Arthur, Ont., by the Department of Public Works.

Can. Fairbanks Board. — The only change in the Board of Directors of the Canadian Fairbanks-Morse Co., which took place at the annual meeting held on March 24 at Montreal, was the retirement of C. H. Morse, sen., who was succeeded by his son, Robert Morse. The Board is now as follows:—Henry J. Fuller, president; Thos. McMillan, P. C. Brooks, and C. G. Drinkwater, vice-presidents; E. R. Whitehead, treasurer; C. H. Morse, jun., H. C. McClary, W. E. Miller and Robert Morse, directors.

Hydro-Electric Plans.—The middle of the summer will, it is understood, see the completion of plans now being made by the Provincial Hydro-Electric Commission for the securing of a new supply of power. The commission is faced with the prospect of exhausting its present contract for 100,000 horse-power, and is weighing alternative propositions—the the purchasing of additional power along the lines now followed, or the widening of the policy of developing its own power initiated with the Wasdell's and Eugenia Falls plants. For nearly a year past the engineers of the commission, acting under the direction of Sir Adam Beck, have been at work upon investigations and estimates for the development of power at the Niagara River, and from the spillways of the Welland Canal. It is believed that both developments will be practicable.

Catalogues

Counting Machines made by the C. J. Root Co., Bristol, Conn., are described in a folder just to hand. The cuts give a general idea of these machines and the reading matter states for what purposes they can be used.

Elevator Buckets.—The Jeffrey Mfg. Co., Columbus, Ohio, have recently issued a new 19-page bulletin and price list No. 143, giving complete information about their standard line of malleable and steel elevator buckets. Copies will be sent to interested persons upon request.

Search Light Projectors made by Enberg's Electric and Mechanical Works, St. Joseph, Mich., are described fully in a bulletin recently issued. This type of projector is designed for installation in the pilot house or on deck, and the principal features of each type illustrated are dealt with. A table is included giving the principal dimensions, weights, etc., of each type.

Universal Center Grinders made by the Hisey-Wolf Co., Cincinnati, Ohio, are illustrated and described in bulletin No. 1102. These grinders are designed to operate on either direct or alternating current for any frequency ranging from 25 to 60 cycles. The new features of these tools are described and tables are included containing the principal dimensions and other data on each type.

Flag Calendar.—We have received from the Lighthouse Literature Mission, Belfast, Ireland, a copy of their 1915 Calendar, the feature of which is an illustrated layout of the new International Code Flags. A scroll heading giving the Mission designation and setting forth its purposes, together with a neat and easily legible "tear-off" monthly date panel serve to complete a useful and highly artistic production.

Frank & Sons Calendar.—The 1915 calendar issued by Frank & Sons, marine and engineering photographers, South Shields, England, comprises a series of representative vessel photographs in black and white, and a monthly "tear-off" date pad pleasingly and artfully arranged. The vessels illustrated include the "Aquitania," the "City of Exeter," the "Varela," and a torpedo boat destroyer, all of them being under steam.

Pump Governors.—Bulletin J. recently published by the Elliott Co., Pittsburgh, Pa., is one of a series dealing with high grade power accessories and is devoted to a description of the various types of pump governor which they make. Each type is fully described and the illustrations, some in section, show clearly the principal features embodied in their design. A series of tables give the chief dimensions and other particulars of each size.

Thornycroft Calendar. — John I. Thornycroft & Co., Caxton House, Westminster, London, England, give evidence of the war spirit dominating all of us at the present time, and particularly the naval phase of it in their current year calendar. H.M.S. Lance, torpedo boat destroyer, ploughing through a sea, is the prominent feature, while illustrations of a motor wagon and motor boat together with a "tear-off" monthly date pad, round out an attractive and especially appropriate publication.

Generating Sets.—Enberg's Electric & Mechanical Works, St. Joseph, Mich., have sent us a copy of bulletin No. 24, describing the "Enberg" dynamos and engines. The generating sets dealt with in this bulletin are vertical, direct connected type from $2\frac{1}{2}$ to 50 k.w. for

marine or land purposes. A detailed description covering their construction is given accompanied by illustrations showing the details and sectional views. Tables are included giving the weights and principal dimensions of each size.

Refrigerating Machinery. — A new booklet has been issued by the York Mfg. Co., York, Pa., principally for use in connection with the Panama-Pacific Exposition. The book illustrates and describes a varied line of ice-making and refrigerating machinery, including various types of ammonia compression machines and absorption plants from one-half ton refrigerating capacity upwards. This attractive booklet may be obtained from the Canadian representatives, the Canadian Ice Machine Co., 82 Chestnut street, Toronto.

Book Reviews

The Institution of Gas Engineers' Transactions for 1914 have been published by E. & F. N. Spon, Ltd., London, England. In addition to the ordinary routine matter, the report contains a number of interesting papers on subjects pertaining to gas engineering read at the annual meeting held last June.

National Electric Light Association.— The report of the thirty-seventh annual convention, held at Philadelphia, Pa., in June, 1914, has recently been published. The report comprises four volumes, and contains the papers, reports and discussions at the sessions, classified in the various sections, such as general, commercial accounting, hydro-electric and transmission.

Factory Power and Costs by Joseph G. Branch, 43 pages, paper covers. Published by the Joseph G. Branch Publishing Co., Chicago, Ill. List price 50 cents. This booklet is the latest published by the author and is a collection of editorials published in "Electricity and Engineering." The booklet contains a considerable amount of interesting matter regarding factory and machine shop drives and the application of power to the best advantage. There are six chapters in the volume and enumeration of the titles will serve to indicate the subjects covered. Chapter I. deals with labor and costs; chapter II. with power costs; chapter III. power distribution losses; chapter IV. power required for machine tools; chapter V. prime movers. The concluding chapter VI. is entitled "Steam still King," from which it will be inferred that the author believes in the supremacy of steam power over other sources of energy. This is essentially a practical booklet, and contains many useful suggestions for the consideration of superintendents or mechanics.

Some Jig Making Practice Considerations and Comment—III.*

By M. R. Lawrence, M.I. Mech. E.

We have come to look upon jigs and fixtures as such highly indispensable accessories to every class of mechanical engineering equipment manufacture that we may be apt in many cases to press them into service unwarrantably. The writer in this paper seeks to point out that their cost feature should be recorded carefully in every instance so as to ensure that they have been profitably applied, as well as being contributory to quality production.

THE present is the third and concluded portion of the paper entitled "Some Jig Making Practice Considerations and Comment. Parts I. and II. will be found in our March 11 and 25 issues respectively.

Another device which will be found extremely useful in every tool-room is what has been christened, for want of a better name, a "sine-bar." A sine-bar is a flat strip of steel, planed true all over, upon which are fixed two hardened and ground plugs, 1 in. in diameter, 10 in. apart. Two sine-bars mounted on an angle-plate are illustrated in Figs. 17 and 18. Mounted in this way, they are used for gauging taper-gauges, either circular or flat. Two holes are bored in the angle-plate exactly 10 in. apart, and the plugs illustrated made to fit them. To set to any desired angle it is only necessary to insert the correct gauges, and the two bars are brought up to touch them, and clamped in position by the knurled nuts illustrated. Standard sizes will be used for developing the Morse taper or any other tapers in current use, and any special taper can be readily developed when required. It is only necessary to look up the natural sign of the angle, multiply it by 10, as the centres are 10 in. apart, and the figure so arrived at is the difference in distance apart in inches between the two plugs fixed to the sine-bars. If a permanent record is required, a correct circular plug can be made to suit. It is wonderful how sensitive this gauge is to use; the slightest want of rectitude, especially in a round taper gauge, is perceived at once.

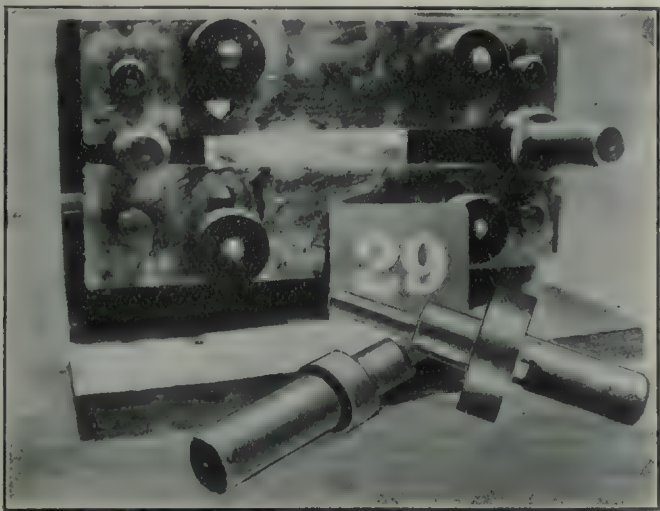


FIG. 17.

FIG. 18.

FIGS. 17 AND 18. "SINE" BARS MOUNTED ON ANGLE PLATE FOR TESTING TAPER GAUGES.

FIG. 19. "SINE" BAR SET UP FOR TESTING ANGLE PLATE.

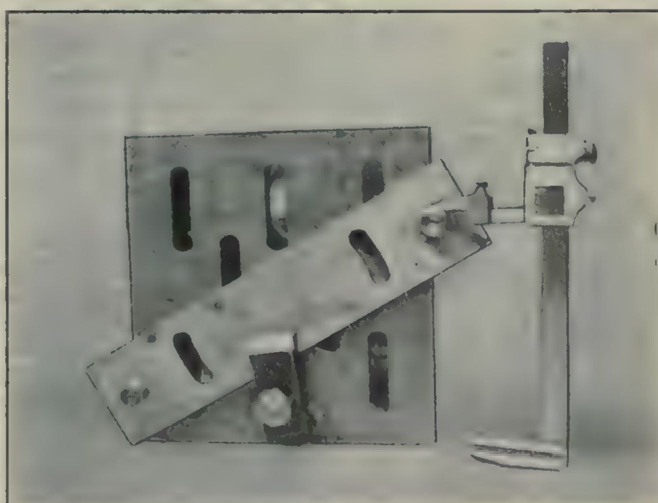


FIG. 20. SETTING "SINE" BAR TO DESIRED ANGLE.

Another good use to which the sine-bar can be put is illustrated in Figs. 19

*Paper read before the Manchester Association of Engineers, December 12, 1914.

and 20. In Fig. 19 it is shown testing the truth of an angle-plate. Upon the sine-bar are fixed two hardened and ground plugs, 1 in. in diameter and 10 in. apart. When mounted in this way, the difference in height between these two plugs and the surface-table is found from the sine-table. Take a concrete instance of a 30 deg. angle. The sine of 30 deg. is 0.500. Therefore, the difference in height between the plugs on the sine-bar is 5 in. The sine of 30 deg. 1 minute is 0.502, so that it will be easily seen that the device is very sensitive. Fig. 21 shows the sine-bar in use for developing an angle gauge. It is clamped up to a hollow block machined true to itself on all faces and set to the half angle required in the gauge. A flat strip of steel with parallel sides is then clamped, as shown, with the end roughly trimmed to the angle. The whole is then mounted on a surface-grinder and the strip ground true to the angle on both sides.

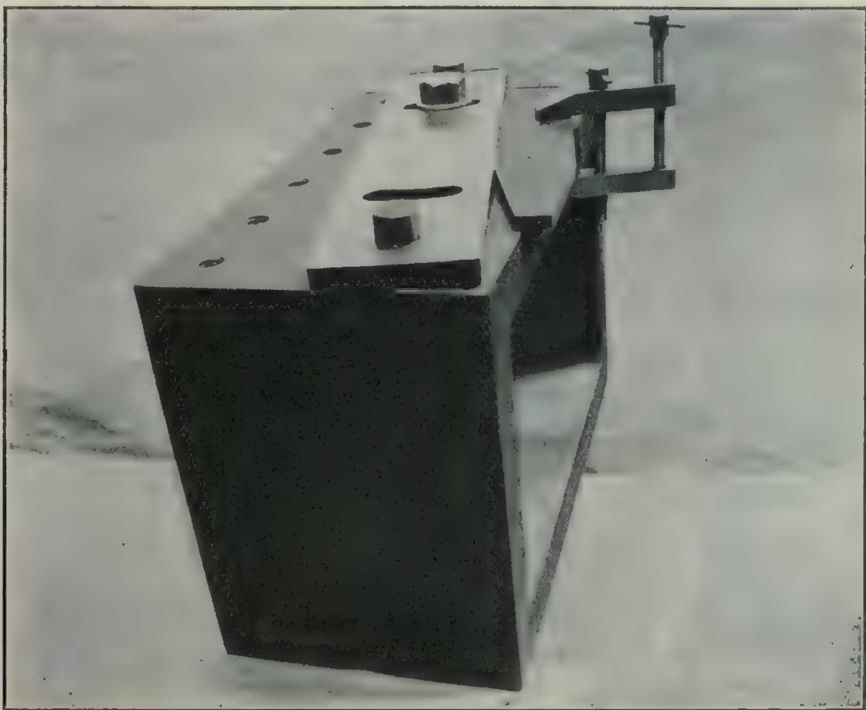


FIG. 21. SINE BAR SET UP FOR DEVELOPING GAUGE.

Fig. 22 illustrates how a wire gauge may be used to measure the exact diameter of a hole which is slightly larger than the length of the gauge. One end of the gauge is held stationary, and the other is moved from side to side in the hole and the lateral movement observed. The oversize of the hole—i.e., the amount it is larger in diameter than the length of the gauge—is calculated by the use of the following formula:—

The oversize of the hole in thousandths of an inch equals the square of the sideways play of the gauge in sixteenths of an inch divided by the diameter of the hole in half inches.

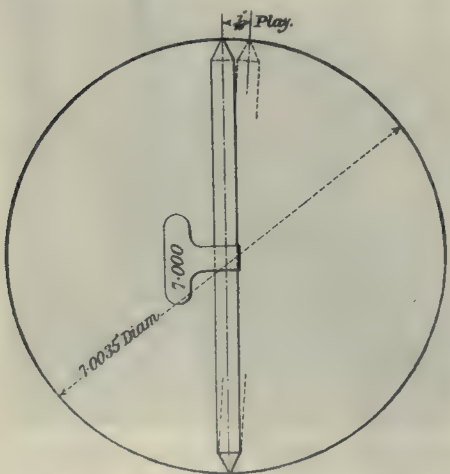


FIG. 22. GAUGING DIAMETER OF HOLE BY A WIRE GAUGE.

Fig. 22 shows a wire gauge, 7 in. long, which has a play of 7-16 in. Therefore: The oversize of the hole in thousandths of an inch

$$= \frac{7^2}{7 \times 2} = \frac{49}{14} = 3.5,$$

therefore, diameter of the hole is 7.0035 inches.

This formula is accurate to the third decimal place when the amount of "play" does not exceed one-tenth of the diameter. It assumes that 32 squared = 1000.

In conclusion, the author wishes to express his thanks to Messrs. Wolseley Motors, Limited, for kindly allowing him to photograph these jigs and devices illustrated, and for lending him the exhibits on the table.

RECONSTRUCTION OF C. P. R. LACHINE CANAL BRIDGE.

THE C. P. R. has kept its contractors working day and night during the past four months on a reconstruction of the bridge over the Lachine Canal, so as to double-track the last remaining stretch of single track between Montreal and Brigham Junction, beyond Farnham, Que. The contracts amounted to over two hundred thousand dollars, and were authorized by Sir Thomas Shaughnessy at a time when railway construction in Canada was supposed to be shut down.

What adds to the interest of this work is that it embodies features unique in bridge engineering. The waterway for traffic remains as wide as before, in spite of the additional track, the construction was carried on in winter, and the operation of trains continued as usual, while the plate girder swing span is reputed the longest space of its kind ever built, being 239 feet 7 inches long.

Especial credit is due to P. B. Motley, engineer of bridges for the C. P. R., who has been able to put through this remarkable work with record speed. The work on the substructure was not started till December 1, 1914, the bridge seats were ready to receive the steel girders on February 8, and the double-track service is now available.

Work Features.

It was found possible to design a double track swing bridge in such a manner as to utilize, after enlargement, the old pivot pier of the original bridge, accommodating two tracks instead of one by the use of four deck plate girders instead of the original lattice truss construction, with the traffic running, as it were, through the bridge. It was thus possible to maintain traffic while the old structure was being demolished and the new one being built. Two girders were erected on the upstream side of the old bridge sufficient to carry traffic while the downstream side was altered, and the other two girders erected and connected up with lateral and other bracing.

The four girders, each of which weighs 112 tons, were shipped in three pieces from the Dominion Bridge Co. shops at Lachine, and were lowered into place by heavy derricks. When all the parts had been accurately assembled, they were riveted into their complete lengths, after which the operating machinery was installed. The weight of the whole swing span is 516 tons, while a 90-foot span, weighing about 143 tons at the south of the bridge replaces the old 40-foot deck plate girder span and accommodates the existing roadway, which is a continuation of St. Patrick Street, Montreal, and admits of the running of a future railway track along the south canal bank, if ever necessary.

Bridge Operation.

The new bridge will be operated by electricity, the power being carried by under-water cables under the canal to the centre pier, and there supplied through duplex 30 h.p. motors controlled from the operator's fireproof house on the north bank of the canal, where a special 30 h.p. motor is kept on hand for emergencies. These cables will be laid after the canal has been unwatered.

The work accomplished since December 1st includes the demolishing of the old single track abutments, the building of a new double track abutment, the widening of the earth embankment, the extension of two piers, one of which entailed considerable subaqueous work and bonding into the old stonework, and the extension of the old north abutment to accommodate the double track, and also to act as the lower storey for the operator's house. Since February 8 the erection of steel and building of masonry has gone on apace. The span will be operated by hand power meantime.

When finished, the bridge will be protected by the most modern interlocking machinery so as to make it impossible for a train to approach it before being properly closed and safely locked, and, in addition, it is impossible for the operator to open the bridge for canal traffic until all railway traffic is stopped at a safe distance from the bridge. All of these operations will be controlled from the operator's house, which will command a view up and down the canal even when trains are passing over the bridge. The new type of bridge will likewise give a much clearer view along the track than formerly, as there is no overhead lattice work projecting above the rail level. The structure will also be provided with a system of lights, as required by the Board of Railway Commissioners, for the protection of shipping on the canal.

The extensions to the sub-structure were carried out by the John S. Metcalf Co., Montreal, and the steel work was fabricated and erected by the Dominion Bridge Co., Lachine, P.Q.

THE BIG GUN.

WHEN it is desired to convey an idea as to the offensive capabilities of any particular warship, it is quite usual to say that the vessel has so many guns of a particular calibre. If such a method of summarizing the armament of a warship is made use of for comparative purposes, says the Liverpool Journal of Commerce, it is quite liable to lead to considerable misconception as to the actual offensive merits of the vessels compared, unless the guns are of practically the same age. The fallacy of this method of comparison, if applied generally, lies in the fact that the many improvements introduced in the art of gunnery have enabled our experts to design and produce weapons of increased power and effectiveness from time to time without altering the calibre.

This point is perhaps best illustrated by the case of the 12-in. gun, which for a number of years held pride of place as the chief offensive weapon of practically all the navies of the world. The 12-in. gun is by no means a recent introduction, it being of historical interest to note that, at the bombardment of Alexandria, H.M.S. Monarch carried four weapons of this calibre. These guns were of the rifled muzzle-loading type, and weighed 25 tons apiece. The projectile weighed 608 lbs., and it was fired by a charge of pebble powder of 85 lbs. weight. This gun cannot, of course, be compared with the modern weapon, nor can it be claimed that it was representative of the type.

First Modern Type 12-in. Gun.

The first modern type 12-in. gun superseded the previous weapons about 1882, and its conception and rapid development were brought about by the introduction of new methods of construction and various important improvements in the nature and character of the powder. The various stages of progress were denoted by giving each class of gun a distinctive mark number, for example, 12-in. Mark V.

Marks III., IV., and V. were of only 30 calibres in length, and fired a 714 lbs. projectile with a muzzle-energy of 18,000 foot-tons, by means of the old prismatic brown powder. In the Mark VIII. weapon, the projectile is increased to its present weight of 850 lbs. This weapon is 35 calibres in length, and develops a muzzle-energy of 33,000 foot-tons. Mark IX. is a 50-ton gun of 40 calibres, having a muzzle-energy of 36,000 foot-tons; while the Mark X. 12-in. gun of 45 calibres weighs 58 tons and develops a muzzle-energy of 48,000 foot-tons. The last gun of this size, namely, the 50-calibre gun, developed 53,400 foot-tons muzzle-energy. The improvements attained in the later types can probably be best illustrated by comparing the penetrative power of each in inches of Krupp's steel with an uncapped shell at 3,000 yards. These figures are given in the following table:—

12-in Mark VIII.—11½ in.
" IX.—12½ in.
" " —14 in. with improved cordite.
" X.—17 in.
Latest weapons.—22.2 in.

From this it will be seen that the penetrative power of the 12-in. gun has been doubled in a period of years approximating to the life of a battleship.

Comparison of 12-in. and 13.5-in. Guns.

It is also of interest to compare the latest type of 12-in. gun with the earlier 13.5-in. weapon. These latter were of 45 calibre, and, consequently, the guns were of practically the same lengths. The 13.5-in. projectile weighs 1,250 lbs., and with a muzzle-energy of 63,000 foot-tons the penetration of Krupp's steel at 3,000 yards is 22.8 in. We thus see that from the point of view of penetration, there is little difference between the two weapons; but apart from other less obvious advantages, the larger gun fires a shell of nearly 50 per cent. greater weight, and consequently carries a much larger bursting charge.

PULLEY SETTING FOR QUARTER-TURN BELT.

By "Woodworker."

SETTING pulleys for a quarter-turn belt has probably caused more argument than any other one subject connected with mechanics. Almost any one around a shop can tell how it is done, while few can do it. It was, therefore, not surprising, when I went to put in a drive of this kind, to have every one from the boss to the clean-up man, tell me how to do it. I did not, however, need the advice of any one, as a simple rule usually gets the belt right the first time, the exception being that where the driving and driven shafts are not an exact right angle, then the pulleys may have to be shifted a little to get an exact track on the belt.

Assuming that the upper and lower shafts are at right angles with each other, I set the driving or upper pulley so that a plumbline from centre of receiving side or face will come exactly in centre of face of driven pulley, less the diameter of driving pulley. The driven pulley is set so that a plumbline from the delivering face of driver will be in an exact line with a line through the centre of a cross-section of driven pulley. The lead of the belt is then on an exact centre from one pulley to the other, either up or down. This is assuming that the upper is the driving pulley. In case of a drive from below, the positions would have to be reversed.

The main idea is to get the centre of the delivery side of each pulley in a line crossways of the pulley receiving the belt. I do not know that it would make any difference if the centres were exactly plumb or not, but the latter idea is carried out, and excepting for the sag of the belt the drive would work as well horizontally as it does on a perpendicular. The action of the belt on a mule-stand is only an amplified example of a quarter-turn belt.—Dodge Idea.

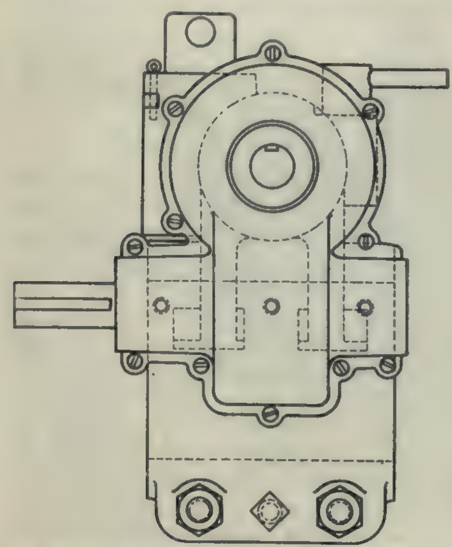
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A MILLING MACHINE ATTACHMENT.

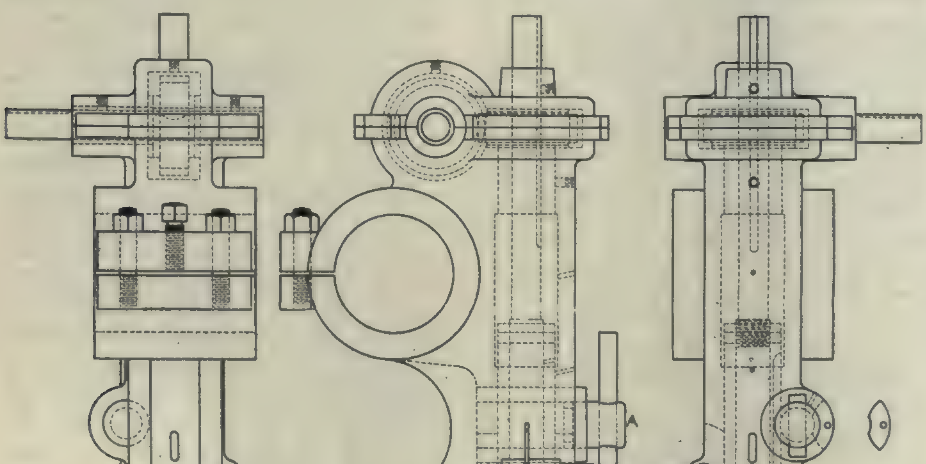
By D. O. Barrett.

FOR rounding out the ends of keyways in engine shafts to the full depth by means of an end mill, the attachment shown in the drawings was designed. Although designed for



MILLING MACHINE ATTACHMENT DETAIL.

this one particular purpose, it could, no doubt, be used on a variety of other work if there were a large number of pieces to be duplicated. It consists of one main casting with a cover for the



MILLING MACHINE ATTACHMENT DETAIL.

helical gears at the top. This casting is bored out to slide on the over-arm, and two ribs extend back and down, forming a bearing on two special steel washers on the arbor, one on either side of the cutter, each of these bearings being 2 inches long.

The spindle is carried in a sleeve, on the one side of which a rack is cut; the spindle is bored for a No. 3 Morse taper. The piece A is of round cold-drawn steel and carries the pinion teeth, 8-pitch, for operating the spindle sleeve.

FIG. 13. GRINDING HANDWHEELS.

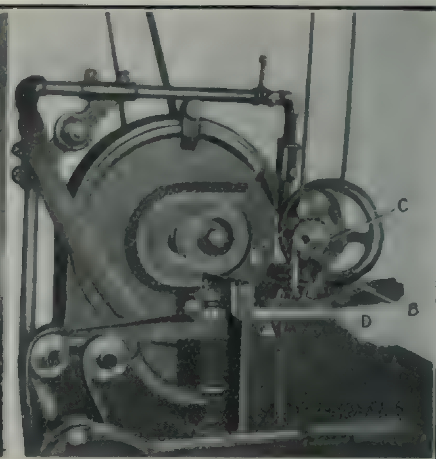


FIG. 14. DETAILS OF THE MECHANISM.

This is the same diameter for the full length, and is held in place by the key shown at the right. A slot is milled into the casting and a corresponding groove is turned in the pinion shaft, after which the odd-shaped key is put in place and held by a spring cotter. The main casting is split at the bottom and provided with a clamping device. A left-hand stud is used here, so that when the handle is out or down, in its most natural position, the spindle will be locked, as no counterweight was provided.

The main casting was bored out $2\frac{1}{2}$ inches for the entire length, with the exception of the enlarged cored portion in the centre. The spindle was $1\frac{1}{4}$ inches in diameter. The spindle gears were of cast iron $3\frac{1}{2}$ inches in diameter, the one around the spindle extending down into the main casting, with a 3-inch bearing. The cross shaft on which the other gear was held by means of a Woodruff key was $1\frac{1}{4}$ inches in diameter and ran in brass bushings held between the two halves of the case. The top of the gear case was also bored out to give a bearing for the spindle, thus giving a bearing on both sides of the gear. The insides of the case were machined and thrust collars of heavy sheet steel placed on each side of the gears. An extra pulley was used on the countershaft to drive the attachment, the vertical spindle thus operating in unison with the horizontal. All bearings with the exception of the one in the sleeve were equipped with grease cups.

When cutting keyways, the regular cutter was used to the full length required. The table was then run back a few inches and the vertical spindle carrying the end mill brought down until the cutter touched the bottom of the keyway. The table was next fed over by hand, after which the spindle was raised up entirely out of the way of the shaft and the sleeve locked.

DEVICES FOR FINISHING SPHERICAL SURFACES.—IV.

By Avery E. Granville.

MANY firms prefer to finish handwheel rims by grinding. The device shown in Fig. 13 is comparatively simple. A stud A is mounted in the table of the grinder.

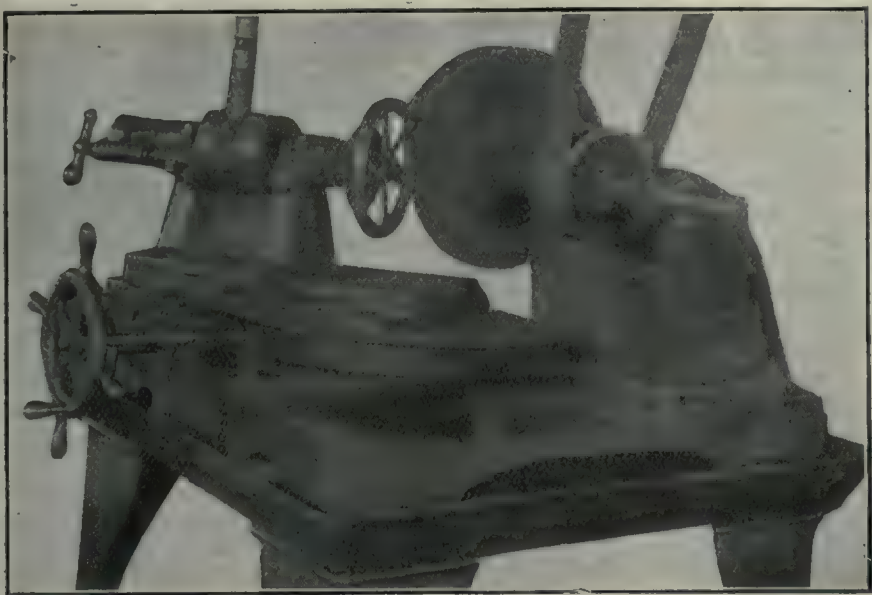


FIG. 15. A SPECIAL HAND WHEEL GRINDER.

Around this revolves the bracket B which carries the mechanism. This latter will be better understood by reference to Fig. 14, in which A is the gear segment on the base of the bracket B. Into this segment meshes the pinion D on the same shaft with the worm gear E. This worm gear is driven from a worm on the shaft with gear C, and the latter is driven from the gear above it by means of a pulley and the belt shown running up above it. The gear C is also on the same shaft on which the handwheel is mounted, so that the small belt drives both the wheel turning and rotary movements.

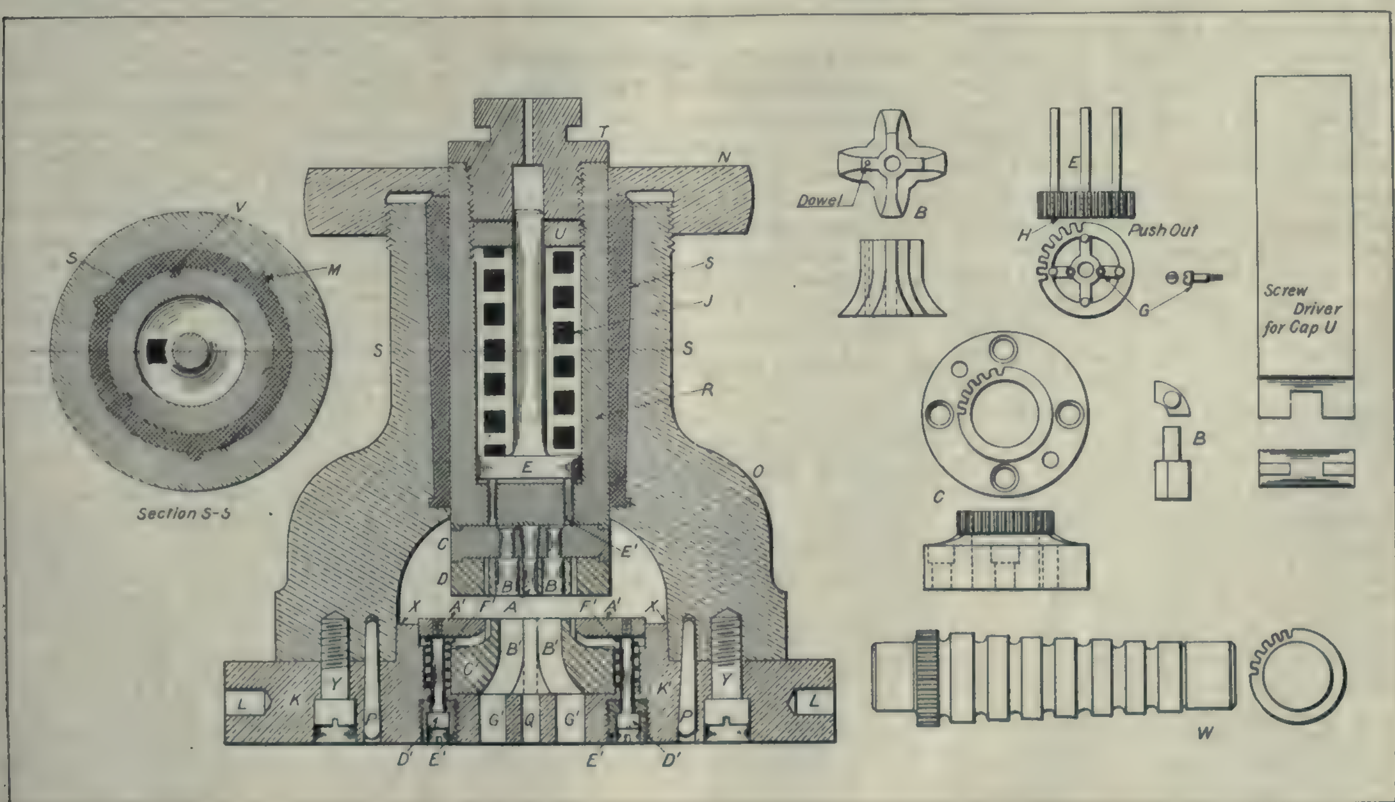
The device just described was made to be used on a regular grinder, but in Fig. 15 is shown a machine constructed by a big lathe building concern expressly for grinding handwheel rims and nothing else. The handwheel is mounted on the end of the grinding spindle and locked with a nut and split washer. It is turned during the grinding process by means of a universal jointed shaft from above. The grinding spindle bracket has a cross adjustment controlled by means of a small ball crank, while the rotary table is operated from the capstan wheel shown in front, through a worm and worm-wheel segment.

UNIQUE SUB-PRESS DIE CONSTRUCTION.—II.

By A. L. Monrad.

PART I. of this article appeared in our February 25 issue, and dealt more particularly with the die detail. In the present instance the punch construction forms the leading feature.

The stripper-plate A^1 is made of low-grade tool steel, hardened and drawn to a dark straw color. The stripper-plate is turned to a snug fit in the recess of base K, and the hole bored exactly in its centre to fit the end of the broach. It is now broached in a similar manner to the die D, but to a sliding fit on the punch C. The web B^1 is made of the best grade die steel, and is fitted tightly into the punch C, being flared out at the bottom for strength. By flaring the web B, we get a wider base to support it, and the punchings have more room, as they slide down and the clearance in the base of die is a little more than a slot, being



UNIQUE SUB-PRESS DIE CONSTRUCTION FEATURES.

in fact an oval shape between the spiders.

The web B has a small dowel pin, about 1-16 inch, through one of the web arms to locate to punch C, as shown in the detail sketch. A cutter must be made to make this web B. With a careful indexing it can be machined very near to size, leaving enough for lapping after being hardened and drawn to a light straw color.

In its centre is bored a hole to a true plug fit for punch A. The punch C^1 is also made of the best die steel, hardened and drawn to a light straw color. It is bored out and lapped to a snug fit to receive the web B. The outside is turned to a push fit in the bottom recess of base K, and the gear teeth cut with the same cutter as the push-out H, to be a true fit in the die D. The punch is screwed and dowelled to the base K from the top, as shown in the detail sketch. The stripper plate A^1 is adjusted with four long shoulder screws D^1. A stiff spiral spring F^1 is placed in the counter-bored hole in the base K. A threaded steel bushing E^1 is fitted in the base K to easily adjust screws D^1, making top of stripper A^1 flush with top of punch C^1 and B^1. When B^1 is pressed up into C^1, it forms the centre part of the punch, and is also a die for the hole in the centre and the holes between arms.

The die and punch for gear teeth should be made first; then make the web and fit it before making punches for holes. In so doing, a more reliable fit can be obtained by making allowance for grinding and lapping. When assembling the die, place the die holder C in position on the plunger and transfer the screw holes through the holder. Now place the die in proper location on to the holder and transfer all the holes through the die into the holder. Drill the four push-out pin holes E^1 through the holder and plunger about 0.005-inch smaller than the original size. Then replace the die and the push-out gear H, and ream these holes through the holder and plunger. The push-out should now slide freely with the arm punchers B^1 and piercing punch A in the right place. We assume now that all the parts are assembled ready for babbitting. An extra cap is made like N, except that it has two elongated grooves milled in the bore for plungers, with ⅛-inch thick ring in between the frame and the cap to form a shoulder for babbitting on top.

A coating of black lead should be painted on the diametrical surface of plunger R. Lower the plunger through the cap and the bottom hole in the frame until the blanking punch enters the die. A gas flame should now be applied all round the frame to warm up the housing, so as to make babbitt flow freely all around. The babbitt should be heated in two ladles to a dark red color, and then poured in from both sides through the elongated grooves on top of the duplicate cap until the babbitt just enters the top of the washer in the cap. Now remove the plunger and cap from the frame, strap the housing on a faceplate and true up the babbitt hole, and cut a spiral oil groove the entire length of babbitt one between each rib. Force the plunger through the housing again and see where it bears the most, then scrape the babbitt until a good forced fit is secured. Remove the frame of the base while the die and punch are all together in their proper positions in the plunger and the base. Grind off the blanking die, piercing punches and stripper together. They should all be ground so all the parts are flush with each other and a true smooth surface. Everything should now be taken apart and the emery cleaned off by washing thoroughly in benzine or gasoline. All the parts should be oiled and placed in proper positions.

This is the best type of a sub-press die. The dies and punches are not backed off. The centre punch hole in the hub is taper reamed from the bottom, but has the top ¼ inch straight. When setting up, the punch should just barely enter die enough to cut a piece of tissue paper. This die should produce a very accurate blank and very little burr, providing it has been properly made. These advantages are two-point in a die of this type, and as it cannot be sheared, it will produce the quality and quantity for a number of years with very little repairing or grinding.

SIGNIFICANT DEVELOPMENTS ARISING OUT OF THE WAR.

STRIKING evidence of the significance of war orders to the steel trade in Canada comes from the stock market—and there is no better barometer by which the actual effect of business and industrial changes can be judged. Last week at Montreal Nova Scotia Steel and Coal stock, which had been neglected at the minimum of $45¾ and had been selling at materially under that figure unofficially, moved above the minimum, and, on rapid trading, advanced as high as $55, a gain of nearly ten points from the official low. This was a remarkable performance under the general industrial and financial conditions prevailing, and in view of the earnings of the company last year. At the same time stimulation was given to other steel stocks and Dominion Steel common also passed above its minimum of 20.

The answer to the question as to the rapid rise of Nova Scotia stock must be that the buying public has reason to believe that war orders have greatly improved the earnings of the company. That the improvement must be material may be judged from the fact that the annual statement published only a few weeks ago showed that during 1914 the earnings of the company had fallen off 76 per cent. and that there was a deficit created of $620,000 for the year. This report came out long after the minimum figure had been fixed. However, late gossip from Nova Scotia goes so far as to predict that not only will the war business bring the company back to a normal position but that the earnings for 1915 promise to be the best in history. The earnings in 1913 were $1,225,000, and in 1914 $415,000.

It is believed that there are to-day between 8,000 and 9,000 shells being manufactured at the plant every twenty-four hours and that there is a profit on this business of $5,000. In addition, the company's 60,000 tonnage has been chartered on a very favorable basis. Working along these lines a figure of $2,000,000 as profits for 1915 is regarded as certain.

Nova Scotia Steel is only one example of the war business. Practically every plant in Canada in a position to take care of any of these orders or to manufacture shell parts can get its share. In addition to the orders placed from Great Britain through the Shell Committee, there is the big order of the Russian Government, which has been estimated as high as $80,000,000, and which the Canadian Car & Foundry Company is distributing over Canada and the United States.

The bulk of this latter business will go to the States on account of price competition, and on account of the fact that Canadian concerns are not in a position to handle it. However, an official of the Car Company states that the Canadian field is steadily developing and that they have been surprised by the large number of concerns which have recently put themselves in a position to get a share of the business. A recent report that shells were being manufactured at a number of cities from Winnipeg through to the coast is only one indication of the broad benefits which Canadian industry is getting in the manufacture of ammunition for the guns of the Allies.

Shaft Connections to Motor.—Motors used in group driving may be connected to the shafting in various ways. If conditions will permit, a good way is to use a motor with extended shaft and locate it in the centre of driven line, coupling each piece of shafting direct to motor by flexible couplings. If the line is short or power light, the motor may be located at one end and coupled direct. The latter method, of course, does away with the necessity of a special motor with extended shaft.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

DESIGNING AN ENGINE CRANK SHAFT.

By J. P. S.

THE main difference between a college man and a self-made man in the mechanical line is that the former has been trained how to seek out specific information concerning the various properties of materials. The college training is also calculated to enable a man to make certain reasonable assumptions of strengths of materials, possible methods of loading, etc., where absolute data is not available. The concession by the greater number of mechanics, that questions of design are entirely out of their reach is unwarranted. The practical mechanic who has mastered the more important principles of design is many times better off than the youth whose father has put him through college but who has failed to give him that training which can only be secured in overalls.

The following simple exercise is intended to illustrate a common method of procedure for the proportioning of an ordinary engine shaft with single overhung crank. The engine is to be of approximately 400 H.P., and the crank shaft will be confined to a length of 12 feet with two bearings.

The size of the engine will be determined by assuming convenient sizes for certain parts and, by trial calculations, obtain the most suitable combination of sizes that will give the desired horsepower. Let the cylinder diameter be 24 inches, the stroke 48 inches and the steam pressure 100 pounds per square inch. Assuming a back pressure of about 5 pounds absolute, a cut-off at 20 per cent. and 3 per cent. clearance, the mean effective pressure will be about 53 pounds per square inch. This may be determined either from tables or formula. Formula for horsepower is,

$$\text{H.P.} = \frac{plan}{33000} \text{ or } n = \frac{\text{H.P.} \times 33{,}000}{pla} \text{ where}$$

n = number of strokes per minute, p = mean effective pressure, a = area of piston in square inches, H.P. = horsepower, and l = length of stroke in feet. Supplying values,

$$n = \frac{400 \times 33000}{53 \times 4 \times 452.39} = 137.63,$$ or an engine of the above dimensions would develop 400 H.P. at $\frac{137.63}{2} = 68.8$ r.p.m., which is a satisfactory speed for a slow speed Corliss.

Piston Thrust. — The maximum pressure upon the piston rod is, area of piston $\times$ max. steam pressure $= 452.39 \times 110 = 49{,}762.9$ pounds. For calculation purposes we will call this 50,000 pounds. Determine approximate size of crank shaft. Greatest twisting moment is $24 \times 49{,}762.9 = 1{,}194{,}309.6$ inch pounds.

The Polar Moment of Inertia (from handbooks) for a round shaft is $\frac{3.1416d^4}{32}$ and the general beam formula is $\frac{M}{S} = \frac{I}{c}$, where M = maximum moment; S = working stress; I = Polar moment of inertia and c = greatest radius.

$$\frac{I}{c} = \frac{3.1416d^4}{32} \times \frac{2}{d} = \frac{3.1416d^3}{16}$$

$$\text{Now, } \frac{3.1416d^3}{16} = \frac{M}{S} = \frac{1{,}194{,}309.6}{10{,}000}$$

$$d^3 = \frac{1{,}194{,}309.6}{10{,}000} \times \frac{16}{3.1416} = 608.25.$$

d = cube root of 608.25.
= 8.48 inches, which is the trial diameter of the shaft.

Crank End Bearing. — From this we can determine the length of the crank bearing. The pressure alternates in direction which allows oil to work in and permits higher bearing pressures, say 450 pounds per square inch (a high value). Total area required is therefore $\frac{49{,}762.9}{450} = 110.58$ sq. inches. Length of bearing $= \frac{110.58}{8} = 13.82$ or say 14 inches.

The crank arm is usually shrunk or pressed on the shaft and has a bearing thereon equal in length to the diameter of the shaft for a steel crank arm. The length of this bearing will be, therefore, about 8 inches and the forcing pressure should be about 60-75 tons. The key may be made equal in width to ¼ the shaft diameter, and, in thickness, from ½ to ¾ of its width. The key dimensions therefore are 2 inches wide, 1¼ inches thick and 8 inches long.

Crank Pin.—The length of the crank pin is usually made from 1.25 to 1.5 times its diameter. The bearing pressure may be from 1500 to 2500 pounds per square inch, say 2000 pounds. The projected area required is therefore, $\frac{49762.9}{2000} = 24.88$ square inches.

The required shearing area of the pin is $\frac{49{,}762.9}{14000} = 3.55$. This is small and need not be considered.

The required cross section to resist bending is obtained from the beam formula $\frac{M}{S} = \frac{I}{c}$ in which M = bending moment $= 50{,}000 \times \frac{\text{length}}{2} = 50{,}000 \times \frac{d \times 1.25}{2}$ (d=diameter).

S = working tensile strength of open hearth steel = 18,000 pounds per square inch.

I = Moment of inertia $= \frac{3.1416d^4}{64}$ (from handbook.)

$c = \text{radius} = \frac{d}{2}$.

$$\frac{I}{c} = \frac{3.1416d^4}{64} \times \frac{2}{d} = \frac{3.1416d^3}{32}.$$

$$\text{Now, } \frac{50{,}000 \times .625d}{18{,}000} = \frac{3.1416d^3}{32}$$

$$\text{or } d^2 = \frac{50{,}000}{18{,}000} \times \frac{32 \times .625}{3.1416} = 17.66$$

or $d = \sqrt{17.66} = 4.2$

This is evidently the value to use. Making the diameter 4½ inches, the length becomes $4.5 \times 1.25 = 5.62$, say 5⅝ inches. This gives a projected area of 5⅝ × 4½ = 25.31 square inches. The required bearing surface has been found to be 24.88 square inches, so that the dimensions obtained by designing the pin for bending satisfies all other considerations.

Main Bearing.—The foregoing calculations may be regarded as preliminary work and furnish us with dimensions which may be used to determine the size of the crank shaft proper.

The length of the main bearing has been found to be 14 inches. The distance between the centre of the main bearing and the centre of the crank pin is

$\frac{14}{2}+8+\frac{6}{2}$ inches, to nearest whole number, = 18 inches. Distance between centre line of crank bearing and centre of outboard bearing is 9 feet.

Considering the outboard bearing as a fulcrum, we find the actual thrust against the crank bearing to be

$$\frac{9+1.5\times 50{,}000}{9}=\frac{10.5\times 50{,}000}{9}=58{,}333$$

pounds.

The crank shaft is subjected to a bending moment, due to the piston thrust, of $18\times 50{,}000$ inch pounds and a twisting moment of $50{,}000\times 24$ inch pounds. This combination is best solved by combining both in either twisting moment or bending moment. Thus, equivalent bending moment

$$= Mb + \frac{\sqrt{(Mb^2+Mt^2)}}{2}$$

where Mb=bending moment and Mt =twisting moment.

Equivalent Bending Moment $= 900{,}000 + \frac{\sqrt{(900{,}000^2+1{,}200{,}000^2)}}{2}$

$= 900{,}000 + 750{,}000 = 1{,}650{,}000$ inch pounds.

Tensile working strength of mild steel shaft under alternating load = 15,000 pounds.

Applying the beam formula $\frac{M}{S}=\frac{I}{c}$ in which M = bending moment, S = working stress, I = moment of inertia which, for a round section $=\frac{3.1416d^4}{64}$ and c = greatest radius $=\frac{d}{2}$ where d = diameter.

$$\frac{I}{c}=\frac{3.1416d^4}{64}\times\frac{2}{d}=\frac{3.1416d^3}{32}$$

$$\frac{3.1416d^3}{32}=\frac{1{,}650{,}000}{15{,}000} \text{ or } d^3=\frac{1{,}600{,}000}{15{,}000}\times\frac{32}{3.1416} \text{ or } d^3 = 1086.5 \text{ or diameter} =$$

cube root of 1086.5 = 10.28.

That is, the diameter of the shaft at the crank bearing must be 10¼ inches. With the 14-inch bearing this gives a projected area of 143.5 square inches and a working pressure $\frac{50{,}000}{143.5}=348.5$ pounds per square inch, which, if anything, is a little high, the bearing could be increased to 15 or 16 inches with good results.

Outboard Bearing. — The outboard bearing sustains half the weight of the flywheel and the pull of the belt. This thrust amounts to approximately ten tons or 20,000 pounds. The thrust on the outboard bearing due to the steam pressure is, using the crank bearing as a fulcrum, $\frac{50{,}000\times 1.5}{9}=8{,}333$ pounds.

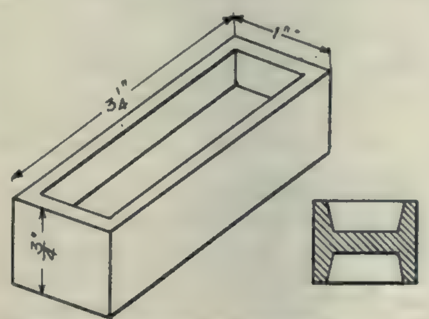
It is evident that this bearing will be designed for the former consideration. Assuming a bearing pressure of 300 pounds per square inch, the projected area required is $\frac{20{,}000}{300}=66.6$ sq. in.

Making the shaft 8 inches in diameter at this point, the length of bearing required becomes $\frac{66.6}{8}=8.3$ inches. This bearing would best be made 10 inches long.

PROJECTED FOUNDRY DATA REQUIRED.

By D. A. Hampson.

A MANUFACTURER uses about 3,000 castings a day, of a general shape as shown in the accompanying sketch, and each lot averages about 500 lb. weight. They are made from brass patterns, eight on a gate, and there are thirty different sizes with a corresponding number of pattern sets. In addition to this, there is a daily consumption of about 800 lb. of similar shape castings, mostly in larger sizes, and a limited amount of smaller cored work.



LARGE QUANTITY CASTINGS SAMPLE.

The nearest foundry doing this class of work is sixty miles away, which makes it inconvenient to secure prompt delivery or hurry orders and to change patterns quickly when large quantities of a few sizes are wanted ahead of others. Anothed trouble experienced is the variety in sizes of castings from the same metal pattern, due probably to the work of different men, all molding being hand rammed.

In order to overcome much of this difficulty and inconvenience, it has been under consideration to erect a small foundry in conjunction with the present machine plant for doing this work, and answers to the following questions in this connection are desired:

How many men would be required for such a foundry?

About what equipment would be most suitable?

About what type, and how many moulding machines would be required, and would machine moulding give more uniform castings?

Would it be necessary to change the size of the patterns when mounting these on machines.

BRITISH RESIDENT PURCHASING AGENT LEAVES.

THE resident purchasing agent of the British War Office, Col. Barton, on April 1, performed his last official duty here in connection with buying of war materials, when he placed an order for 500,000 pounds of candles with firms in this country. The order will be divided up in large monthly shipments, and means a distribution of some $450,000 among Canadian manufacturers.

Col. Barton left for New York on April 2, and sailed for England via the Lusitania. Lieut. Johnston will look after the office here until the large clothing order, valued approximately at $4,500,000, is all shipped. This is expected to take place within a month and after that date the Dominion Government will handle all purchases of war materials made in Canada.

The hard work in connection with War Office buying in this country has now been completed. Manufacturers know what is required, how and where to ship the goods, and if future Canadian materials are needed, repeat orders can be readily placed.

SHELL MANUFACTURING AREA EXTENDING.

THE manufacture of shells for the British army, which has been carried on almost entirely in Eastern Canada, is to be extended in the West as the result of a conference held at Ottawa, on March 31, between Hon. Sam Hughes, members of the Shell Committee, of which Col. Bertram is chairman, and representatives of various Western cities. Following the conference, David Carnegie, ordnance expert, accompanied by experts from the Department of Mines and McGill University, left for the West, where they will visit a number of cities and ascertain to what extent factories and foundries there can be utilized. Shells have been manufactured in Winnipeg for some time and it is thought that similar work can be done in the other cities, represented at the conference. These consisted of Brandon, Regina, Moosejaw, Portage La Prairie, Medicine Hat, Calgary, Lethbridge, Edmonton, Vancouver and Victoria.

FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

INCREASING THE OUTPUT OF YOUR FOUNDRY.*

By G. K. Hooper.**

LIKE every other manufacturing establishment, a foundry is a device for making money out of labor; therefore, in designing such a plant, every means should be embodied to enable the laborers, whether skilled or unskilled, to do the utmost useful work which they are reasonably able to perform, having in mind their bodily, mental and social necessities.

In the early beginnings of the foundry business, so little information was available concerning its fundamental sciences of metallurgy, practical geology and the hydrodynamics of molten metal that skill in an operative was largely a matter of intuition or genius. The trade, therefore, being built upon this, has not adapted itself as freely as possible to the sub-division of labor and use of mechanical appliances as have other trades, and the productiveness of the labor in it has not advanced rapidly. The processes, also, under this condition have a tendency to be wasteful in time and space.

In the foundry where no sub-division of labor is used, this productiveness averages, according to studies which I have made, from 50 to 60 per cent. With the sub-division of labor and the use of mechanical appliances and power, it rises to about 75 per cent. With well arranged machine tools in the machinist trade, we are advised that the productivity of the labor has risen as high as 80 per cent., and on some classes of work to a higher figure.

What Adam Smith Said.

As there are yet a number of foundry executives who believe that it is unwise, if not impossible, to use machinery and divide their labor, or in other words, to use what is known as the gang system, I would like to quote what Adam Smith, the first great expounder of economics, says about sub-division of labor in his work known as "The Wealth of Nations," written about 1755. He speaks as follows:—

The greatest improvement, in the productive powers of labor and the greater part of the skill, dexterity and judgment with which it is anywhere directed or applied seems to have been the effects of the division of labor. The great increase in the quantity of work which in consequence of the division of labor the same number of people are capable of performing, is owing to three different circumstances:—

> First—The increase of dexterity in every particular workman.
>
> Second—To the saving of time which is commonly lost in passing from one species of work to another.
>
> Third — To the invention of a great number of machines which facilitate and abridge labor and enable one man to do the work of many.
>
> It is the great multiplication of the production of all of the different arts in consequence of the division of labor which occasion in a well-governed society that universal opulence which extends itself to the lowest ranks of people. Every workman has a great quantity of his own work to dispose of beyond what he himself has occasion for, and every other workman being exactly in the same situation, he is enabled to exchange a great quantity, or, what comes to the quantity of his own goods for a great same thing, for the price of a great quantity of theirs. He supplies them abundantly with what they have occasion for and they accommodate him as amply with what he has occasion for, and a general plenty diffuses itself through all the different ranks of society.

This sounds something like a treatise on the evils of restricting output. Mr. Smith gives also some statistics concerning results of sub-division in the pin and nail-making industries, generally as follows:—With pins, one man by hand could make but about 20 per day, or 10 men could make 200 per day; whereas, by sub-division of the 18 different operations and with indifferent machinery, 10 men do make about 48,000 per day. With nails, he reports:—

> A blacksmith who has been accustomed to make nails can seldom, with his utmost diligence, make over 800 to 1,000 nails per day. I have seen several boys under 20 years of age who had never exercised any other trade but that of making nails, and who when they exerted themselves could make, each of them, upwards of 2,300 nails per day, the same person blowing the bellows, stirring and minding the fire, heating the iron and forging every part of the nail, being also obliged to change his tools in forging the head.

We might conjecture from the foregoing that there were scientific management and efficiency experts, even as early as 1750, and that achievement in the efficiency profession has fallen off since that time as no such percentages of improvement as the above figures entail, are offered us to-day. With the better technical understanding which now exists concerning the underlying sciences of the foundry trade, there is more and more application of engineering talent to the investigation of the problems which arise. It is also as much a matter of engineering to find out what the human machine can be reasonably expected to perform as it is to properly judge the fitness of any mechanical device for foundry operation.

In foundry design, quite as much as in any other occupation, the quantity, quality and form of the product establish the limits within which a design must be contained in order to reach that most desirable situation, the providing for improvement of plant and equipment and the obtaining of substantial net profits.

Application of Labor to Product.

The application of labor to the product is the next consideration. If skilled labor is necessary, means must be used to apply the skill only to those operations in which it is needed, sub-division of labor and the use of mechanical appliances and power being embodied wherever this can be profitably done.

In the molding and casting operations, a considerable number of foundries to-day do sub-divide the labor on their product and employ separate labor gangs for pouring, shifting and shaking-out, sand-handling and core-setting. Some objection is made to this practice, but, as you have heard, it is sound economics to sub-divide the labor, when the amount of product warrants it and an increase of skill may reasonably be expected to result, giving an increased production with corresponding reduction of cost. Some confusion may arise at the commencement of such a method of operation, but this can be minimized by using the most skillful and intelligent operatives as gang bosses.

*Presented at a meeting of the Newark, N.J., Foundrymen's Association.

**Of the Hooper-Falkenau Engineering Co., New York.

To do away with the laborious part of lifting and transporting materials, there is the industrial railway with or without locomotive, the overhead monorail trolley track, either with or without power-driven traveling hoist, the air hoist, the jib crane, traveling wall crane and overhead crane which covers nearly the entire floor area. Combinations of these are frequently used.

Molding Machines.

For molding, molding machines of one kind or another, from the simple hand squeezer and the pneumatic hand rammer to the more elaborate power-ramming, pattern-drawing, rock-over type are available, each well adapted to some particular purpose. The molding machine is employed to advantage on a great variety of product and more and more uses are found for it every day. You are, however, familar with mistakes which have been made in the wrongful selection of molding machinery for any given work resulting in confusion as to the merits of such devices, and in loss. The general proposition still exists, however, that molding machinery properly adaptable to the work will increase profitably the productiveness of the laborer.

Metal Pouring.

Arrangements are made for improving the productivity of the pouring operations by bringing large quantities of hot metal to the work in bull ladles; by taking the molds to the melted metal, at or near the cupola; by trucks running on the floor; by cars on industrial tracks pushed by steam or electric locomotives, and by conveyors on which the molds are weighted or clamped, sometimes jacketed; poured while in motion; cooled and removed at the proper time and with flasks, bottom boards, weights, etc., returned to the molding stations while the sand and castings go elsewhere for suitable attention. There also are special forms of ladles, such as the multi-lip, which add to the productiveness of the labor.

Metal Melting.

In melting equipment, there is available for the cupola the tilting or rocking spout and the charging machine; for the reverberatory furnace in malleable work, the overhead traveler for lifting bungs and handling the fresh charge in dumping trays or skips; for the open hearth steel furnace, the charging machine and gas producer. To these two latter types of furnace, a number of attempts are being made to attach the mechanical stoker and to utilize also the direct burning of coal in powdered form. For non-ferrous metals, there is the tilting furnace.

Sand and Castings Handling.

In sand-handling, a number of devices are successfully used from the simple sand-cutting machine operating on the sand heap on the foundry floor to the complete apparatus which takes shaken-out sand, cools, cleans and tempers it, mixes it with the proper proportion of new sand and delivers it again to the mold maker.

In shaking out and handling castings, sprues, etc., mechanical appliances also have been developed from the simple grating on which molds are dumped to the complete conveyer which carries the shaken-out sand and castings to shaking gratings on which they are separated and from which they are discharged into some suitable arrangement for cooling, the sprues and runners having been disposed of at the proper time. The cranes, travelers and industrial tracks, previously mentioned, also are available for this work, it being a matter for study in each case whether it is more economical to move the iron to the molds by hand or mechanical means, or vice versa.

When quantities are large and the product such that a few sizes of molds may be standardized, even though of considerable difference in size, there will be combined all of these devices, such as the molding machine, sand-handling system, mold conveyor and shaking-out conveyor, all of the operations being conducted uninterruptedly throughout the entire working day. Attempts have been made to operate such plants by means of two or three shifts throughout the whole 24 hours. The success of this development so far is doubtful. You will recognize that such 24-hour operation could not, in any way, increase the relative productivity of the labor.

Cleaning Castings.

In cleaning, progress has been made from the hammer and chisel, steel brush and emery wheel to the power chipper, metal saw, sprue cutter, exhaust tumbler and sand blast machine. Long tumbling mills have been attempted a number of times in which the castings to be cleaned were fed in at one end and discharged fully cleaned at the other. These present attractive possibilities when material is fairly uniform in size and shape, and is not hollow, deeply cored, recessed or of considerable variation in size.

For these latter conditions, it has been found that while certain sizes in the charge may be satisfactorily cleaned in this way, the whole contents will not be as satisfactorily cleaned, so that on the whole, these devices have been a success only where the work is uniform in size and simple in nature. The exhaust tumbling mill and the sand blast machines, such as the revolving and traveling table machines and the sand blast barrel each are in satisfactory operation to increase the productiveness of labor in cleaning operations. Mechanical appliances embodying grinding wheels are available, increasing the effectiveness in removing roughness. They also are used to roughly-dimension such pieces as can be finished in this way.

Acid Cleaning.

When large quantities of castings are made, which on account of being machined require careful cleaning to save time and tools, pickling plants, embodying mechanical handling, are designed in which the castings are handled on pans, acid poured upon them by ladles or from a hose connected with a reservoir to which the acid is again pumped after draining. The castings then are delivered to a washing floor where they are washed while still on the tray by streams of water under considerable pressure, after which they are dried and sorted. This means has given economical results for castings which are required to be very clean.

In the core department, various problems present themselves calling for the application of sub-division of labor and of mechanical devices. There are sand driers, mixers for properly amalgamating the necessary materials, ramming machines of various types, cutting - off and pointing machinery, handling devices for saving steps for the coremakers and ovens, more or less elaborate, for making the best use of time, labor and fuel.

A raw material yard also is a problem for engineering thought. There we have lifting and carrying machinery in the shape of locomotive and overhead cranes and industrial cars, together with scrap and pig breakers. There is also the sprue breaker which simplifies considerably the handling of this awkward and bulky material. Elevators to the charging floor usually come under the head of yard machinery, and here we have also the slag barrel and water barrel for preventing waste of material.

Attention is now being given to the saving of sand by rebonding processes in order to economize in raw material and in the disposal of waste, as in sand the binding material is but a small proportion of the entire mass and injury to this binding element which prevents its further usefulness results in the loss of disproportionately large quantities of the refractory portion of the mass.

The Foundry Building.

The building which is to house the proper arrangement of apparatus is also a subject for engineering thought. The first consideration, of course, is that the full possibilities of the arrangement

of the apparatus and operations shall be developed. Care should be executed to prevent the manufacture of anything that might be an obstacle to the development of any particular function, that is, the building should be of such type of construction that changes in its form, openings, etc., may readily be made. The march of improvement is so rapid in this country that it is impossible to predict how often the manner of turning out products will be changed. The building, therefore, must be adaptable.

Two Storey Foundry.

I personally prefer brick and steel construction to any other and have had no reason to alter this opinion after considerable experience in building this type of manufacturing plant. Where much machinery is used, especially conveying machinery, it often develops that instead of using sub-grade construction, an advantage, both in first cost and operation, is gained by making the building of more than one storey. This has led to the so-called two-storey foundry, which is in successful use where the quantity of production is great and the use of machinery extensive. Co-existent with the foregoing considerations are those of proper lighting, ventilation, heating, etc., that the human machine may operate in freedom from mental or bodily discomfort, thus securing the utmost which it is reasonable to expect from human endurance. The construction itself calls for careful study that wear and tear from usage and the elements shall be properly attained without too great a first cost.

Among the elements to which the structure is most subject to attack is fire; principally from the inside on account of the nature of the occupation and somewhat from the outside, by reason of the proximity of other structures. There are available the sprinkler, the metal window sash, wire glass and the tile roof to minimize this source of loss. They are big dividend payers to the foundryman.

Permanent Molds.

A considerable economy is to be attained in operation in the present state of the foundry business by the use of the well-recognized principles of subdivision and application of machinery and power. From a 50 per cent. productivity in the case of labor not subdivided and little or no machinery, to 75 per cent. to be attained where these principles are most fully applied, represents a saving of 50 per cent.

A productivity of 75 per cent. is, in my belief, about the limit that can be reached in the foundry art with such operations as are necessary at this time. There may be, of course, individual instances which will exceed this, but the figure refers to the average. It may be that we shall find in the permanent mold a method which will considerably increase the relative productivity of the labor. Time studies on repetition work to which the permanent mold would be applicable, show that there is many times as much labor consumed in making the present mold by present methods as is used in pouring and shaking-out, while the material handled in the making of molds is frequently ten-fold or more the weight of the castings produced. Also, there are several pieces of equipment to be handled to one casting or gate of castings. If the permanent mold could be developed these ratios would be cut down and less material as well as fewer parts would be handled. Of the 50 per cent. increase in productivity of the man, at present available, however, you can all secure a part. Some sub-division of labor and some mechanical apparatus is applicable to part or a whole of the operations in the jobbing shop and in the shop which handles a considerable range of standard work.

A mechanical engineer and manufacturer of world-wide reputation has said that "the achievement of a result regardless of cost, is not engineering." Having this in mind, it is essential to carefully study all conditions. In arriving at a practical conclusion as to the installation of machinery and the subdivision of labor, the cost of installation and operation and the possible increase of product must be considered as well as the increase of productiveness of labor.

We have been called upon to examine cases where unintelligent application of mechanical devices materially diminished the productiveness of the labor in addition to entailing heavy expense in installation and operation. On the other hand, the highest productivity and hence, greatest economy in production have been obtained where the apparatus and sub-division of labor have been most intelligently employed.

COMING CONVENTIONS.

Master Boiler Makers' Association, Chicago, Ill.—May 26-28.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

AMERICAN FOUNDRYMEN'S ASSOCIATION CONVENTION.

THE annual meeting of the American Foundrymen's Association will be held at Atlantic City during the week of Sept. 27, with headquarters at the Marlborough-Blenheim hotel, business and technical sessions being conducted on Young's steel pier, almost directly opposite the Marlborough-Blenheim. The exhibit of foundry equipment and supplies under the auspices of the Foundry and Machine Exhibition Co., will be held on the steel pier, and will open on Saturday, Sept. 25. A tentative program of the convention has been adopted as follows:

Monday, Sept. 27.

Registration at headquarters, Young's steel pier.

Tuesday, Sept. 28.

10 a.m. — Opening session, joint meeting between the American Foundrymen's Association and the American Institute of Metals.

2 p.m.—Operating session.

Wednesday, Sept. 29.

10 a.m.—Joint General session between the American Foundrymen's Association and the American Institute of Metals.

2 p.m.—Gray iron session.

8 p.m.—Business session, annual address by president, election of officers.

Thursday, Sept. 30.

10 a.m.—Simultaneous sessions on steel and malleable iron.

2 p.m.—Simultaneous sessions on steel and malleable iron.

7 p.m.—Annual banquet.

Friday, Oct. 1.

10 a.m.—Final business session.

It will be noted that this tentative program provides for two sessions for the discussion of cast steel and two meetings will be devoted to malleable iron. At the last meeting in Chicago, insufficient time was allotted for the discussion of the many valuable papers presented, and to enable those who are interested in these topics to discuss the papers at length, two sessions will be devoted to steel and malleable work. The change in the session at which officers are elected was effected for the purpose of giving the new officers an opportunity to meet prior to the close of the convention for the purpose of outlining the ensuing year's work.

The committee on papers is actively at work and members desiring special topics discussed should send suggestions either to the secretary, A. O. Backert, Cleveland, Ohio, or to Harry B. Swan, chairman of the papers committee, Cadillac Motor Car Co., Detroit. The various committees appointed at the last annual meeting are also at work, and many interesting and valuable reports will be presented.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

ENGINE LATHE WITH QUICK-CHANGE GEARS.

THE description and illustration refer to an engine lathe with quick-change gears, made in two sizes, 16 in. and 18 in., by the Canada Machinery Corporation, Galt, Ont. It is quite a modern type high-speed tool, embodying great strength and capable of securing high degree accuracy in production.

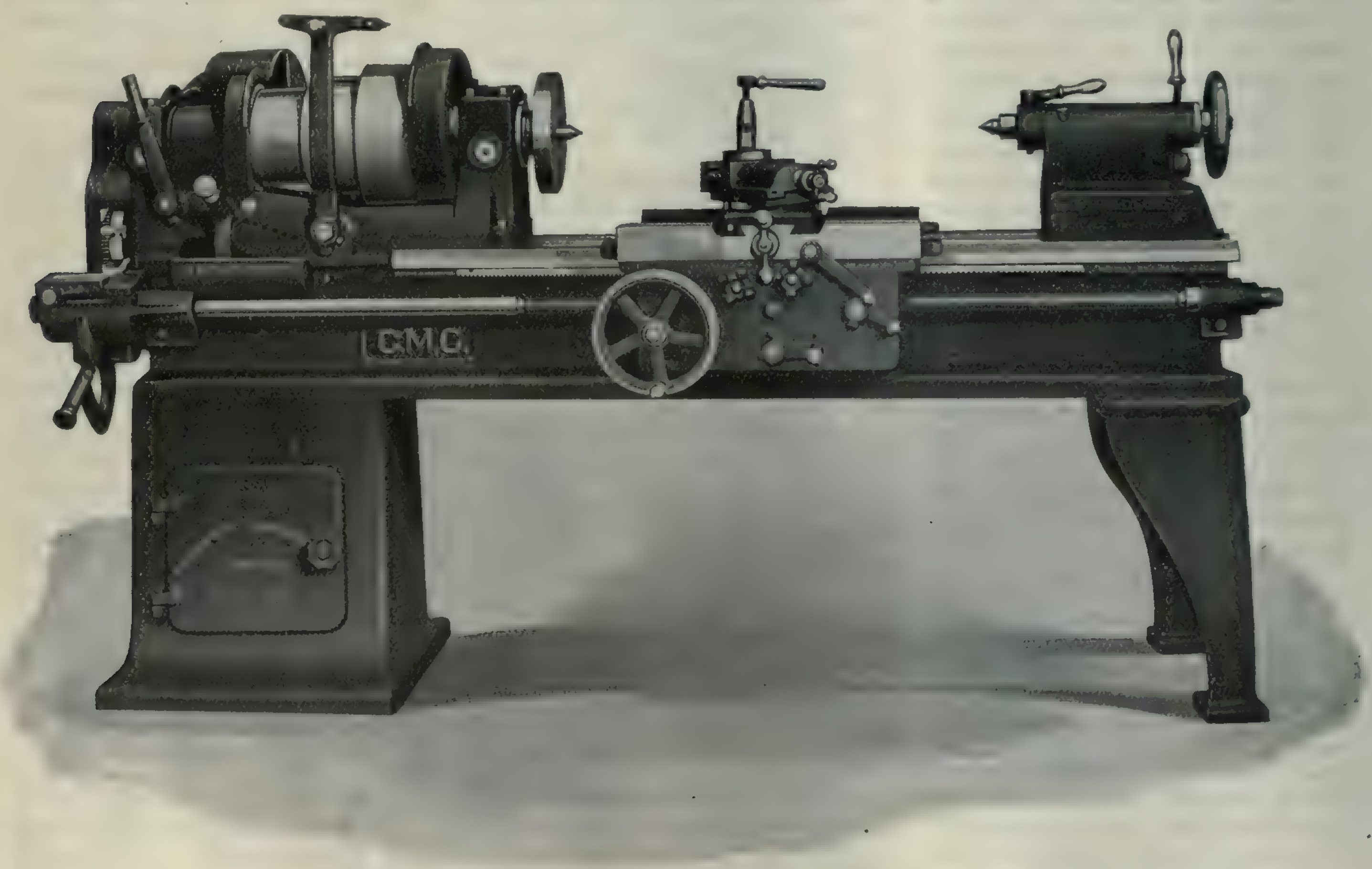
It is provided with a heavy deep bed, giving maximum stiffness under the cut. The saddle is substantial throughout, with great strength in the bridge, the latter having a bearing on the flat surface inside the front V in addition to the two V bearings. The headstock is of the three-step cone double-back geared type with extra wide belt, and is provided with a belt shifter. This belt shifter, besides saving time, forms a safety device preventing injury to the operator; his safety is further provided for by the guarding of all gears. The quick-change gears enable any threads from 2 to 64 to be cut without calculation or removal of gears. The machine in detail is as follows:—

The bed is unusually deep and rigid, and is thoroughly braced with cross ribs of box section. It is provided with three inverted V's of liberal proportions. The headstock and the tailstock each rest on one V and one flat surface, and the saddle bears on two V's and also on the flat surface. The brackets attached to the bed are made with a tongue fitting a groove in the bed, and the rack is of steel securely screwed and dowelled to the bed. The box leg under the headstock is hollow and provided with convenient shelves for holding extra parts.

The headstock throughout is unusually massive, and is of the three-step cone double-back geared type. It is equipped with split phosphor bronze bearings, which are provided with large oil wells to ensure ample lubrication at all times. The spindle is turned and ground to size from special high carbon spindle steel, and has a hole bored from the solid throughout its entire length. The cone has extra wide faces to enable wide belts to be used.

An improved belt shifter, for rapidly and safely shifting the belts to any of the steps of the cone, is part of the regularly furnished standard equipment. It consists of an arm bolted to the head carrying a belt guide and provided with a self-locking pin for securing the arm centrally over each step. A corresponding shifter is provided on the countershaft, and by means of the manipulation of these levers, the belt may be shifted to any desired cone step in the minimum time without the operator endangering himself in the slightest.

The feeds and screw cutting changes are instantly obtainable by the movement of a lever to any of the different locations as shown on the index plate. It is impossible to engage either the automatic cross or longitudinal feeds when the machine is set for screw cutting or vice versa. The thread of the lead screw is used for screw cutting only. The feeds may be instantly reversed in the apron by a convenient



16 IN. AND 18 IN. ENGINE LATHES WITH QUICK CHANGE GEARS.

lever. The saddle is securely clamped when using the cross feed, and the lead screw is reversed for right and left-hand threads by means of the reverse plate on the head. For indicating correct point for engaging nut for thread cutting, a thread chasing dial is provided on the carriage, obviating the necessity for stopping the lathe when screw cutting. Micrometer adjustment is provided on the handles of the cross screw and compound rest graduated in 1/1000ths and 1/16ths of an inch. A compound tool rest is provided, with base graduated in degrees. The tailstock is rigid and heavy, and is clamped to the bed by a locking lever conveniently situated. It is so shaped as to permit compound rest to be set at right angles without interfering. The spindle is graduated in fractions of an inch for use in boring.

Standard equipment includes countershaft with two friction pulleys, necessary shifters, special cone belt shifter, follow rest, steady rest, large and small face plates, necessary wrenches. Special attachments, such as taper attachment, turret on the bed or saddle, turret tool post, etc., can also be furnished. These lathes can, if desired, be arranged to be driven direct by constant or variable speed motor, or by single pulley drive. General specifications for the two sizes are as follows:—

Design and operation features	16 in.	18 in.
Swing over shears	16⅛ in.	18¼ in.
Swing over saddle wings	16⅛ in.	18¼ in.
Swing over compound rest	9¾ in.	11 in.
Width of belt on cone	3 in.	4 in.
Speed of range spindle	12 to 336	12 to 336
No. of speeds to spindle	18	18
No. of thread and feed changes	50	50
Feed range	4 to 128	4 to 128
Thread range	2 to 64	2 to 64
Weight of machine complete, with 6 ft. bed	2,100 lbs.	2,750 lbs.
Weight of each extra 2 ft. bed	150 lbs.	200 lbs.

DIRECT-CONNECTED EXCITERS.

A SINGLE great reservoir of power, to be drawn upon as required, was once believed by power plant designers to be the ultimate development of the central station. Carrying out this idea, all of the generators were to be connected to one bus-bar and would be excited from a central direct current system. However, as central stations were built in increasing capacities, the necessity for sub-division on account of excessive short-circuit currents became manifest.

The present tendency is to lay out the station as a number of independent units, so that trouble on part of the system will not cause a shut-down of feeders and apparatus other than those directly affected. Especially is this trend noticeable in the case of hydro-electric plants where the power is used over a wide territory, and must be delivered over long transmission lines, which are particularly liable to trouble. To render each generator unit independent, many engineers—among them P. M. Lincoln, president of the A.I.E.E.—now favor the use of individual exciters, each connected to its own generator.

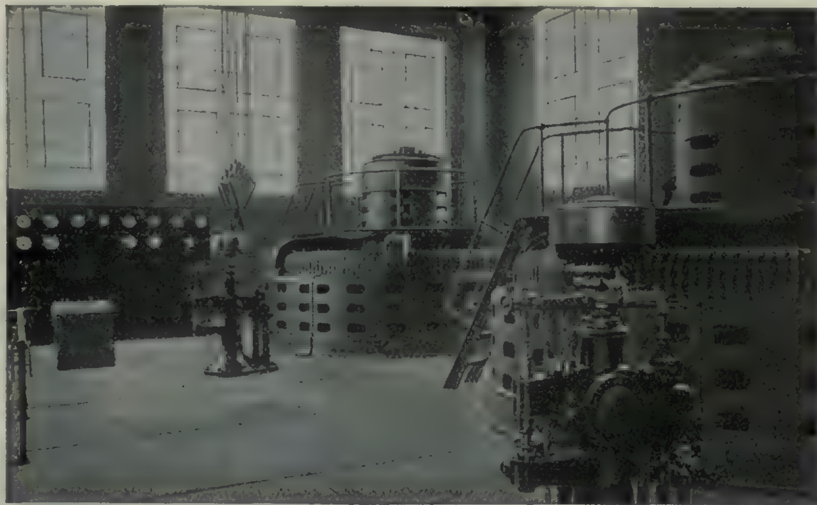


FIG. 2. HYDRO-ELECTRIC INSTALLATION WITH DIRECT CONNECTED EXCITERS.

The Westinghouse Electric and Manufacturing Co. has perfected a line of exciters especially adapted for such service. The chief point urged against direct-connection is that trouble in the exciter necessitates shutting down the generating unit unless leads are provided for exciting the generator from some other exciter unit. Hence reliability is the primary requirement in exciters designed for direct-connection.

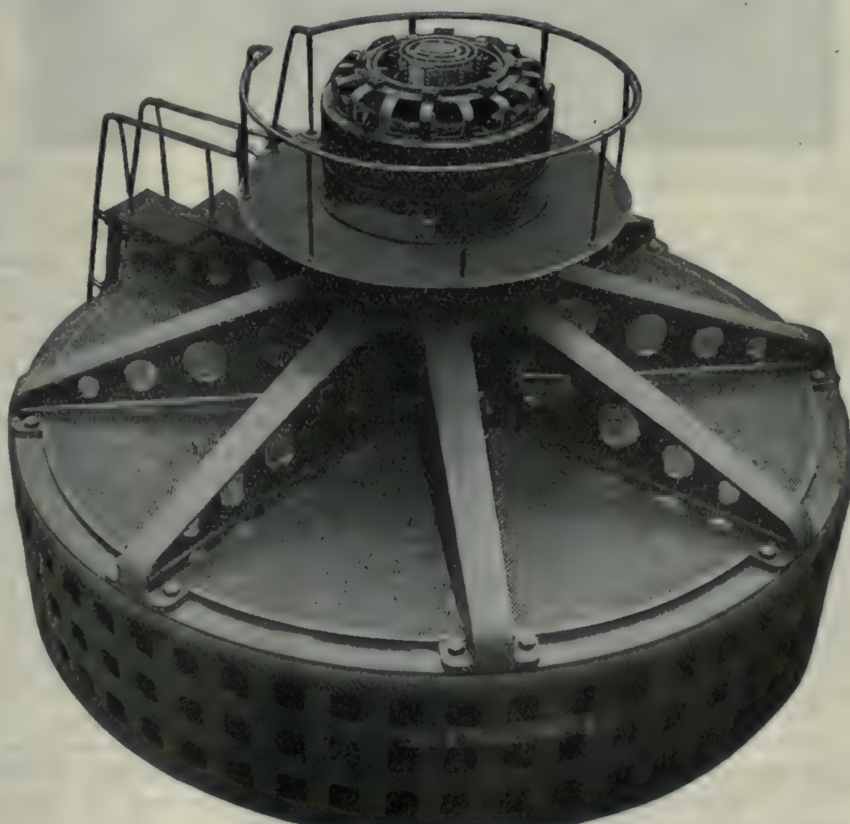


FIG. 1. DIRECT CONNECTED EXCITER ON VERTICAL GENERATOR UNIT.

Westinghouse designers have fully recognized this fact, and these exciters are characterized by rugged mechanical details and great overload capacity.

While these exciters are generally built especially for the particular generator to which they are to be attached, in the details of their design and construction they are similar to the standard Westinghouse engine and belt-driven direct-current generators. Several methods of mounting the exciter are employed. In the case of a vertical generator the exciter is carried by the thrust-bearing bracket. With a horizontal generator, the exciter frame may

be mounted on an extension of the generator bed plate, on a bracket attached to the bearing pedestal, or on a separate base.

The use of the direct-connected exciter has the following advantages:—Each generator is dependent only upon its individual exciter, the number of plant auxiliaries is reduced, rheostat losses tend to be less, belts and belting troubles are eliminated, and a neat and compact appearance is secured.

The cost of the direct-connected exciter varies somewhat with the type of main generator with which it is to be used. This is due to the varying amount of excitation required by the alternator, which depends materially on its operating speed. A slow-speed unit will require more excitation than a higher-speed machine of otherwise similar characteristics, and the slower the exciter runs the more expensive it will be. For this reason, direct-connected exciters for engine-driven sets or slow-speed water-wheels make a more expensive layout than where the higher-speed water-wheel, belted or turbo-driven generator is employed.

FIG. 3. HORIZONTAL TYPE GENERATORS WITH DIRECT CONNECTED EXCITERS.

In addition to the advantages of greater freedom from trouble, etc., it is frequently true that an outfit of direct-connected exciters will be cheaper than any other arrangement. This is particularly the case in hydro-electric plants where other arrangements, affording equal independence, entail a much greater first cost.

LAKE FERRY "ONTARIO NO. 2" LAUNCHED.

THE large car ferry "Ontario No. 2" was successfully launched on April 3 from the yards of the Polson Iron Works, Ltd., Toronto. The ferry was christened by Mrs. Hugh Calderwood, wife of the consulting naval architect for the Ontario Car Ferry Co., owners of the vessel. The launching operations were superintended by William Newman, naval architect for the builders, who also supervised the construction of the ferry.

The "Ontario No. 2," like her sister ferry, "Ontario No. 1," will run between Coburg, Ont., and Charlotte, N.Y. She is designed principally for carrying coal cars, but will have, in addition, accommodation for 1,000 passengers on the upper deck. On the lower deck are four tracks of rails capable of taking 30 cars. A service is maintained between the Grand Trunk Railway and the Buffalo, Rochester and Pittsburg Railway. The dimensions and general particulars of the vessel are as follows:

Length, 318 feet; beam, 54 feet; depth from wheelhouse, 75 feet; moulded depth, 20 feet 6 inches; tonnage, 5,400; horse-power, 4,500; capacity, 30 loaded cars; launching weight, 2,100 tons; displacement of water at launching, 5,000 tons.

She is about the same size as her sister ferry, but built more heavily and with capacity for four more cars.

Twin sets of jet condensing triple expansion engines are being installed, each having cylinders 20½ in.-33 in., and 54 in. diameter by 36 in. stroke, and making 110 r.p.m. The boilers, of Scotch type, are four in number, each being 14 ft. diameter by 12 ft. long. Howden's forced draft is a feature of the boiler equipment. The electric lighting plant will consist of two direct-connected steam-driven generating sets of 15 k.w. and 20 k.w. respectively of Canadian General Electric Co. make.

The vessel bows are constructed for ice-breaking, and lifeboat and raft equipment carried on the top deck.

Captain Forrest, of Coburg, will be in command of the ferry, and Allan Nichol will be chief engineer.

At the conclusion of the launching ceremony, a buffet luncheon was served in the Polson Ironworks' offices, the guests being received by the president of the company, Col. J. B. and Mrs. Miller. Among those present were: Mr. and Mrs. Hugh Calderwood, Howard E. Kelly, vice-president G. T. R.; Col. and Mrs. J. B. Miller, A. H. Jeffrey, secretary of the company; Mayor Church, Toronto; Captain H. H. Miller, J. W. Greiner, chief engineer of the G. T. R. ferry system; J. F. McMillan, of the Kingston Shipbuilding Co.; W. Inglis, of John Inglis & Co., Toronto; Captain J. B. Foote, W. H. Smith, general manager of the Ontario Car Ferry Co.; G. A. Bowman, A.G.F.A. of the B. R. & P. Railway; Mr. and Mrs. William Newman, J. A. Sing, etc.

COUPLING TROUBLE.

IN a factory where I was employed several years ago, says a writer in The Dodge Idea, there were two lengths of shafting coupled together with a compression coupling. This coupling gave quite a lot of trouble, as the nuts would work loose on the bolts and there would be a constant grinding of the shaft against the keys. The result was the keys would soon be cut away and the keyseat so badly damaged as to allow the shaft to turn in the coupling. Then the engine would have to be stopped, the belt thrown off and a new key made, and maybe a new keyseat cut.

The first time this trouble occurred was when the few machines on the line were not needed. I had the repairman make a joint in the shaft. By the use of a hack saw the two ends of shafting were cut a little more than half-way through, each being cut to the same depth. They were then cut in from the end on a bevel, and filed to a nice fit, forming a bevel lap joint. When the coupling was put on and the bolts screwed up tight, the trouble had disappeared.

Truth is an asset and a lie is a liability. Good business men tell the truth because it pays. We make money from our friends, not our enemies. The wise public service corporation gives the best service because in so doing it gets the best returns.

* * *

There are no yesterdays, except in that unquenchable influence they leave behind. Our to-days are the only vital segments of time that we can utilize, We have no assurance of any to-morrow. Keep the golden hours of to-day busy and set them with sixty active minutes.

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Vol. XIII. APRIL 8, 1915 No. 14

PRINCIPAL CONTENTS.

OUR WAR INTEREST A PROFITABLE INVESTMENT.

RECOVERY from the shock produced by Britain's declaration of war against Germany and Austria induced our business interests to at once set about instilling into the minds of their employees and the public generally the instruction, to become oblivious of the conflict of nations and pursue their multifarious avocations with peace-time regularity and assiduousness. Under the then circumstances the propaganda was timely and the best possible. Nobody of even moderate intelligence, however, looked for any practical and lasting results, and the most that could then or can now be said in favor of the action taken is that it did produce in some degree the desired effect.

In spite of the fact then that it was well nigh impossible to banish war development interest, and that a well meaning attempt thereto was made, we have to-day not only become involved in a mental sense, easily transcending our initial display, but are engaged, to the almost total exclusion of every other consideration, in the practical work of "seeing the thing through" in a real Empire patriotism sense. When we say that Canada, agriculturally and industrially is devoting herself exclusively to the work of aiding Britain and her Allies to bring the war to its one and only desirable conclusion, we mean that our Dominion in its every feature is so committed. Other than for our own immediate needs, production is relative to the war requirements of our own, the Imperial and Allied Governments.

Agriculture over the length and breadth of our land has been stimulated as at no time previous in our history, and taking account of the prices ruling for the fruits of the soil, it needs no stretch of imagination to assume that given seasonable weather for the ensuing five months, even irrespective of bumper receipts by our farmers and transportation companies, and through them to our industries generally, a foundation will have been laid, both systematically and scientifically, from which hitherto undreamed of achievement and possibilities will arise.

Again, what is true of agriculture is equally so of industry relative to manufacturing. For other than war requirements our factories are doing little, and in no section is this more noticeable than in that of our machine tool and general engineering works. A like condition exists, but of a still more realistic kind in similar plants in the United States. It may be urged and quite reasonably that with respect to the production of shrapnel shells on which so many of our engineering establishments are now engaged, we are apt to draw comparisons which place normal or peace-time production in an altogether unwarrantably unfavorable light.

Whether such be only a tendency or an unquestionable reality, shell manufacture in our leading plants may aptly be classed as booming. The way in which those who direct our engineering and steel production enterprises have grasped the opportunity afforded by the war, and are making good on the more or less accurate workmanship and material quality output called for by the shell specifications leads us to conclude that greater commercial achievement and possibilities are in future store for these particular concerns.

New equipment of the most up-to-date type for shell making has been lavishly installed, and standard equipment with ingenious and easily applied attachments and devices has also been largely and effectively utilized. Operators have become enthused—for personal and patriotic reasons, and not in the least because of the exceeding novelty of the product and the rapidity with which finished shells materialize from their craftsmanship.

The net result to our iron and steel industries will be to stimulate a desire to maintain a higher grade equipment installation and give spirit to our mechanics to cultivate a higher degree intelligence.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates 1/4 to 1/2 in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 9 50	$10 00
Copper, crucible	11 00	11 50
Copper, unch-bled, heavy	11 00	11 50
Copper, wire, unch-bled.	11 00	11 50
No. 1 machine compos'n	9 50	10 00
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 00	9 50
No. 1 brass turnings	7 00	7 25
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
1/4, 3/8 in.	64	47	....	....
1/2 in.	69	56	....	....
3/4 to 1½ in.	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in.	74	61	73	60
4½, 5, 6 in.	....	....	72	59
7, 8, 10 in.	....	....	68	56
X Strong P. E.				
1/4, 3/8 in.	57	46	....	....
1/2 in.	64	53	....	....
3/4 to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
1/2 to 2in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
3/8 in.	58	41	....	....
1/2 in.	63	50	....	....
3/4 to 1½ in.	68	55	....	....
2 in.	68	55	64	51
2 , 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in.	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$16 75	$16 75
Electrolytic copper	16 50	16 50
Castings copper	16 25	16 25
Tin	54 00	54 00
Spelter	12 00	12 00
Lead	5 50	5 75
Antimony	23 00	25 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, 3/4-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
1/8in	$ .05½	1/8in	$ .12	1/2	$ .32
1/4in	.06	1/4in	.07½	3/4	.35
3/8in	.06	3/8in	.07½	1	.37
1/2in	.08½	1/2in	.11	1¼	.52½
3/4in	.11½	3/4in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 100-lb. kegs, per cwt	6.75
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.69
Linseed oil, raw, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$8.00
5/16 inch	5.35
⅜ inch	4.60
7/16 inch	4.30
½ inch	4.05
9/16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. galvanized)	4 50	4 50
Queen's Head, 28 B.W.G.	4 60	4 60
Fleur-de-Lis, 28 B.W.G.	4 30	4 30
Gorbal's Best, No. 28	4 60	4 60
Viking metal, No. 28	4 20	4 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., April 5, 1915.—The approach of the opening of navigation is a new factor which has added a distinctly better tone to the market for lines for outside consumption. As yet it cannot be said that the volume moving has materially increased but there is a comparative optimism in the inquiries being received. That the improvement will be lasting is questionable but it is the belief that the hand-to-mouth policy adopted with the outbreak of the war has resulted in stocks being starved to the minimum and that there should now be some buying, particularly with the means of facilitating transportation at hand. The field for ammunition manufacture is evidently widening and with it the demand for metals is well maintained, despite the fact that the situation shows some tendency to ease off. Inquiries for certain lines of tools continue active from the same cause. The steel trade continues to drag. Price changes are not important.

The Steel Trade.

The volume of business passing continues small, and the consumption of heavy materials is expected to continue so, there being little indication of heavy industrial or transportation demand.

Opening of navigation this year is not likely to affect either demand or prices. Some of the mills are watching the American situation with itnerest in view of the rail orders secured by the Algoma Steel Co., and they find encouragement in the tone on the other side of the line. Whether more rail business will come this way or not remains to be seen but, although price competition is likely to be even keener now that the American makers have been aroused, report has it that Canadian concerns are hopeful of bringing further orders this way.

Ammunition orders continue as the chief matter of interest for the majority of the steel plants capable of making shells, and the outlook for continued business seems to improve steadily as the war progresses without definite indication of early cessation.

Pig Iron.

The situation shows little change during the week and prices remain on the same basis. Some little improvement in tone is indicated in relation to the approach of the water transportation season.

Machine Tools and Supplies.

The field for the manufacture of shells is widening with the continued demand and this has been noted particularly in connection with the recent big business placed with the Canadian Car Co. by the Russian Government. Officials of the company report that they are going to be able to place much more of the business on this side of the line than had at first been anticipated. The consequence is that the demand for equipment is broadening. The fact that machine shops in practically all parts of Western Canada are getting ammunition orders is significant.

Metals.

The manufacture of shells continues to drain the metal markets to some extent and although tin is quoted off a couple of cents and spelter is inclined to be easier, antimony shows a slight advance and there is little to indicate that materially lower prices are to be looked for while the war demand continues. Tin is quoted at 54c. New York has reported easier conditions for a week or so, but each decline has been met by a reaction which has recovered much of the loss.

Spelter continues at 12c, but there are some quotations which shade under this figure. St. Louis recently suffered quite a marked reaction but the low price was evidently the result of manipulation just as the previous high had been, and there were indications that the basis was merely nominal, practically all makers delivering on placed orders at higher figures. Lead continues strong and prices are inclined to go higher, 5¾c being quoted in some instances. Antimony is advanced to 23c, an increase of 1c. The advance comes at the same time as a decline is noted in New York, but for some time the price here has been materially under that quoted in the States.

Toronto, Ont., April 6, 1915.—During the past week there has been less activity in business circles owing to the Easter holiday season. Industrial conditions are, however, improving gradually, although the volume of business is not equal to last year at the corresponding period. The approach of spring is tending to stimulate business in some trades apart from the orders for war material which are still keeping an increasingly large number of factories busy. One trade which should now be showing an improvement is particularly dull, that is, the building trade. The local building returns for March, 1915, are a long way behind those of the corresponding month last year. The same remark applies to the months of January and February.

The returns for the fiscal year just ended show a large decrease in customs revenue, representing nearly 28 million dollars. Part of this falling off is attributed to scarcity of ocean tonnage, although there has been a decline in imports from the United States. Sir George Foster, Minister of Trade and Commerce, has announced that a campaign will shortly be started to promote trade between Canada and Russia. The campaign will be conducted by Conrad F. Just, former Trade Commissioner of the Dominion in Germany.

Steel Market.

There has been a quiet week in the steel market, but indications point to a gradual improvement in trade. This is largely due to orders for war supplies which are increasing in volume and are to some extent making up for the ordinary business lost owing to the war. The shell industry is responsible for the bulk of the new business, but development is taking place in other lines and will materially benefit the steel trade. Billets, wire rods, nails and forgings are being shipped in considerable quantities to England. It is reported that W. C. Franz of the Algoma Steel Corporation is negotiating with the Pennsylvania Railroad for an order for steel rails and if successful, that mill will have all the tonnage it can take care of for some considerable time.

Conditions in the steel trade in the States have materially improved and large orders for finished and semi-finished steel have been booked for shipment to Europe.

Machine Tools.

Machine tools for making shells continue to be the most interesting feature, although the ordinary business is beginning to pick up. Many inquiries are being received by local dealers for shell equipments but satisfactory deliveries are very difficult to obtain as nearly all makers of tools are full up with orders. Tenders close on Friday for tools not already awarded for the new Technical School. A number of milling and woodworking machines, foundry equipment and electrical apparatus are included.

Supplies.

Although the volume of business booked has been curtailed to some extent on account of the holidays, indications point to an improvement in trade. The market is steady and there are no price changes to note.

Metals.

The metal exchanges in London and New York have been closed for the Easter holidays. With the exception of copper and tin, most markets are showing a weak tendency, but quotations are unchanged.

Copper. — The copper market is strong and the general situation unchanged. Lake copper is quoted at 16¾c per pound.

Tin.—The market is steadier to-day in London and stronger. The general situation, however, shows practically no change. Tin is quoted at 54c per pound.

Spelter.—The spelter market is weaker in London to-day. Local quotations are unchanged and nominal at 12c per pound.

Lead.—The market has weakened but quotations are unchanged at 5¾c per pound.

Antimony.—The antimony market is very quiet and there is very little change in the general situation. Local quotations are nominal at 25c per pound.

Aluminum.—The market is steady and quotations unchanged at 23c per pound.

WAR SUPPLIES CONTRACTS IN UNITED STATES.

ACCORDING to recent Washington advices, United States Government officials are unable to give anything like correct figures of the business being done in war supplies. A large proportion, how large it is impossible to say, goes to Canada first and is shipped from there to England, France and Russia.

In the most authoritative circles it is estimated that the principal items in the $400,000,000 worth ordered in America in six months were:—Motor cars, $25,000,000; arms, explosives and the like, $105,000,000; iron and steel, $65,000,000; uniforms, socks, sweaters, etc., $30,000,000; chemicals and hospital supplies, $6,000,000; soldiers' shoes, harness and

other leather products, $18,000,000; miscellaneous, including food supplies known to have gone to the armies, $160,000,000.

It can be said without fear of contradiction, says Steel and Iron, that the Allies have now contracted for the entire output of the arms and ammunition factories of the United States, while scores of concerns are enlarging their plants and running three shifts a day to fulfill their foreign contracts.

Noteworthy Features.

Many of these companies do not know they are turning out goods for a foreign power. They pretty well surmise it, however, and they don't care. They deal only through a broker or agent and with great secrecy.

Goods are sold for delivery here and shipment is at the buyers' risk. The buyer enforces secrecy, because the goods are contraband. The manufacturers surround their plants with high fences and troops of armed guards, not only in order to co-operate with the buyers, in maintaining secrecy, but also to prevent meddling by agents of governments hostile to the buyers. The 75 firearm and ammunition factories in the United States ordinarily employ 20,000 persons. Now their forces number 50,000 and are increasing.

High Explosives Demand.

The enormous demand for high explosives has forced prices to high levels. Picric acid, used in the making of explosives, has risen from 25 cents to $2.50 a pound, and the entire supply on hand has been bought up. Those men who still have guncotton on hand which can be delivered within 30 days are asking 78 cents a pound. The usual price is 20 to 25 cents. In February, the French Government tried to buy 24,000,000 pounds of gun cotton, offering 65 cents. It was unable, so contracts were placed with a number of mills running over two years.

More than 10,000 automobile trucks have been shipped to England and France since August 1 last, but from the way new orders are coming in, this branch of the trade is only just beginning. The French war authorities figure the average life of an auto truck is only seven days.

Chief Buying Agents.

Their are thousands of buying agents for foreign governments all over the country, but the largest contracts are coming through Charles M. Schwab, or the Bethlehem Steel Co., and J. Pierpont Morgan, head of the New York banking firm. Mr. Schwab has made two visits to Europe since the war began and has obtained contracts amounting to more than $50,000,000. His Bethlehem works are making 12-inch guns for the Allies, but, in addition to what is turned out there, he has sub-let orders in a dozen different cities. Morgan is now the general purchasing agent of the British Government and all orders go through his firm. Every section of the country, where manufacturing is a feature is benefiting from war orders, although these in many cases are not large enough to offset the depression existing in domestic lines.

New U.S. Markets.

Many orders are from governments which never before bought in the United States market, and American business men believe they can hold this trade after the war is over. They argue that much of the work now being done here for Great Britain, to take an instance, has previously been done in Germany, and that the bitter feeling arising from the war will preclude its being done there again.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British.—Lieut. Johnston and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

A Philadelphia factory is making swords for the British army. Such a contract had never been received in the United States. In the past, British swords have been made in Germany.

In the Pittsburgh district, at Homestead, many Germans who formerly worked for the Krupps are employed. They are now making war material for the Allies, although, of course, they do not know this definitely. The men in the factory are not informed for whom a particular 6-inch shrapnel shell is being made.

Miscellaneous Contracts.

Some odd items are reported. The French Government has paid New England manufacturers $260,000 for snowshoes. One concern in Philadelphia is turning out a folding saw with wooden handles for cutting wire entanglements. When the war started, the Armies used steel pliers for this work, with the result that many men were shocked to death by high voltage electricity.

All sorts of factories have been pressed into commission to make things useful in war. A company in Bridgeport, Conn., which usually makes cemetery monuments of bronze, is now turning out forgings for an auto truck concern, which has a large order from the Allied Countries. Bridgeport, by the way, is enjoying huge prosperity because most of its industrial concerns are working on war orders.

All through Massachusetts and Connecticut war orders are helping to overcome the depression of the first few months of the war. The Fore River Shipbuilding Co. is very busy. It is generally reported to be building 10 submarines for the British Navy, these to be delivered at end of the war. In addition it has 25 others building.

Brokers and Middlemen Fattening.

Demand for many particular articles has been so great that the Allied Governments have signed contracts at prices most attractive for the manufacturers. In addition, it is pretty well established that middlemen, brokers and agents are gathering millions in commissions, some of which are exorbitant. It is said by a Chicago merchant, for instance, that there is a well-organized band of extortionists, with agents in all the big cities on both sides of the Atlantic and headquarters in New York, which is exacting a toll of from 15 to 20 per cent. on practically every shipment of war supplies that leave the country. In general, however, the agents of each government maintain that their nation is buying right, while stating a belief that other nations are being fleeced. A well-known Russian exporter of New York City says the Russian Government is suffering the most heavily of all. He has sent over a report for wide publication in Russian in which he says that already $20,000,000 has been lost through the exploitation of American commissioners and brokers.

England is financing purchases through the house of J. P. Morgan & Co. Russia, on the other hand, sends over her various bureaucratic officials and military and governmental officers who know nothing whatever about American business methods, and in many cases do not even speak English language. They come straight from the offices of the Ministries of War, Industry, Communications and Finance.

MUSSEN'S, LTD.

WE are officially advised that John J. Robson has been appointed permanent liquidator of Mussen's, Ltd., and that the firm's application to continue the conduct of the business for a period of

six months has also been granted. Further to the above, we cannot do better than refer to the candid and highly commendable spirit with which the management of this old-established concern is getting to work, to not only offset and overcome its present difficulties, but to bring about the return of its old prestige on a basis more substantial and efficient than perhaps attainable in times less strenuous than the present. We quote from the official statement over the signature of W. H. C. Mussen, president of the company as follows:—

"We take this opportunity of stating that we feel able to demonstrate to our creditors that we will succeed in the efforts which will be put forward to reduce our stock, collect our open accounts and materially reduce overhead charges, with a view to getting into a position to reorganize and continue in business. While we are in liquidation, we are carrying on an active campaign for business, and we trust that we may continue to receive your support. We have a good connection throughout the country and all purchases made by us from now on will be paid for by the liquidator. Operating as we are, under the most strenuous conditions which have ever existed in Canada, we know that it will take some time to achieve the result at which we are aiming, but if we continue to receive the support of our principals as in the past, we are satisfied we can show good results and ultimately re-establish this business on its old footing.

"Since the liquidation proceedings were put into effect, we have been flooded with letters from manufacturers, as well as from our customers, extending their hearty support and assuring us of their continued patronage. We, therefore, take this opportunity of thanking our friends for this evidence of confidence in us and in our ability to win out. We also desire to impress upon our customers the fact that we are carrying on 'business as usual,' and that, although we were always pleased to receive their orders, we are now more anxious than ever to be favored with same.

"We conclude by asking our principals to continue the support which has been so freely given us in the past, and we ask our customers to give us an opportunity of supplying them with any material which they may require. All inquiries will be promptly attended to and orders will be filled without delay."

Canada's War Orders.—An official memorandum regarding war orders states that at least ninety-five million dollars' worth of war material and equipment has been ordered by the Allies from Canada, and that this expenditure does not include that incurred on behalf of the Canadian contingents, which exceeds twenty-five millions. Seventy-two Canadian companies have been given orders for machining shrapnel shells, and 67 are engaged in making the various parts required. The orders placed in the United States amount to more than a billion dollars.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Bedford, Que.—The Bedford Mfg. Co. will build an extension to their plant.

Ottawa, Ont.—The city will equip a machine shop for the fire department.

Toronto, Ont.—The Martin Pump & Machine Co., Davies avenue, have received a contract for shells.

Brantford, Ont.—It is stated that the Steel Company of Canada will make shrapnel shells at their plant here.

Toronto, Ont.—A building permit has been issued to the St. Clair Foundry Co. for the erection of an addition costing $2,000 to their plant.

Stratford, Ont.—The Bartlett Motor Co., of Toronto, will probably establish a plant here. A by-law will be submitted to the ratepayers.

Charlottetown, P.E.I.—It is announced that Bruce Stewart & Co., will rebuild their foundry and blacksmith shop, which was recently destroyed by fire.

Cowansville, Que.—Messrs. Lemay, of Dunham, and Lenou, of West Brome, have taken over a plant for the purpose of re-establishing a machine shop and garage.

Belleville, Ont.—The Marsh & Henthorne Co., of this town, has secured a contract to supply 5,000 eighteen pounder high explosive shells for the British Government.

Moose Jaw, Sask.—The Saskatchewan Bridge and Iron Co. may be awarded a contract for shrapnel shells. In this event the Canadian Automobile and Tractor Co. plant would be taken over and equipped with the necessary tools.

St. Mary's Ont.—The Water, Light and Heat Commission has recommended the purchase of a gasoline-driven pump for the power house, and Chairman Richardson and Commissioner Sanderson, will carry the suggestion to the Town Council.

Municipal

Meaford, Ont.—The council have appointed F. W. Thorold & Co., Toronto, engineers for the proposed waterworks extensions.

Hespeler, Ont.—The by-law to fix the rate of assessment on the Stamped Enamelled Ware Co. factory at $64,000 was defeated on March 29.

Dundas, Ont.—The Public Utilities Commission is at work on a new plan for waterworks extension, which will provide for a reservoir or storage basin, in addition to the one now in use.

Brampton, Ont.—At the Town Council meeting held recently, the tender of Goldman & Co. for waterworks extension was accepted, their offer being for the sum of $10,063 and accrued interest.

Electrical

Kincardine, Ont.—Improvements to the street lighting system are contemplated.

Ottawa, Ont.—The city council have been granted permission by the legislature to raise $50,000 for extensions to the electric lighting system.

General Industrial

Vancouver, B.C.—The National Biscuit Co. factory was damaged by fire recently.

Medicine Hat, Alta.—The Lake of the Woods Milling Co., will build an extension to their elevator to cost $2,000.

Kelowna, B.C.—It is reported that D. W. Sutherland of this town, contemplates establishing a broom factory here.

Hamilton, Ont.—The Grasseli Chemical Co., will extend their plant at a cost of $27,000. A building permit has been taken out.

Dundas, Ont.—It is announced that the Canadian Hart Wheel Co., of Hamilton, may begin the construction of a plant here in the near future.

Brantford, Ont.—The Brantford Computing Scale Co. will extend their plant. The new building will be 45 ft. by 130 ft., two storeys high, and will cost about $20,000.

Schumacher, Ont.—Timber is now on the ground for the construction of a mill on the Schumacher Syndicate property. The mill will have a capacity of 150 tons daily. It will be completed some time in August.

Contracts Awarded

St. Thomas, Ont.—The City Council has awarded the contract for municipal supplies to Ingram & Davey, Ltd., of this city, at $418.22.

Hamilton, Ont. — The Gartshore-Thomson Co. has been awarded the contract for 26-in. cast iron pipe, the price being $31.75 per ton.

Regina, Sask.—The Regina Foundry Co. has been awarded a contract by the city for the steel work for the sewage disposal plant, at $1,640.

St. John, N.B.—The British War Office has placed an order for ten thousand 4.5 high explosive shells with T. McAvity & Sons, St. John, N.B.

Toronto, Ont.—The Board of Control has awarded the following contract to the Turbine Equipment Co.: 36-in. stop valves, at $541 each; 30-in. stop valves, at $392 each; 24-in. stop valves, at $285 each, and one 36-in. check valve, at $855.

Saanich, B.C.—Council has awarded the following contracts: — Balfour, Guthrie & Co., pipings and special castings; the Victoria Machinery Co., 100 hydrants at $33 each; Yarrows, Ltd., 100 hydrants at $35 each; the Rensselaer Co., 25 hydrants at $37.25 each.

Tenders

Winnipeg, Man.—Tenders are being called for a 5,000,000-gallon turbine pump and motor. M. Peterson, secretary Board of Control.

Toronto, Ont.—Tenders will be received, up to Tuesday, April 13, 1915, for constructing an incinerating plant on Centre Island. Specifications and form of tender may be obtained at the Street Commissioner's Office, City Hall.

Toronto, Ont.—Tenders will be received up to Tuesday, April 13, for the supply and installation of an asphalt tank for city asphalt plant. Specification and forms of tender may be obtained at the Works Department, City Hall.

Toronto, Ont.—Tenders will close on April 9 for machinery and tools for the new Technical School not already contracted for. A complete list was given in Canadian Machinery in our issue of March 4. The principal equipment required includes: Milling and planing

machines, woodworking machinery, foundry equipment and electrical apparatus. Specifications at the Technical School, 149 College Street, Toronto.

Trade Gossip

The National Cash Register Co. has been granted a supplementary license to use in Ontario capital to the extent of $800,000.

The Canada Machinery Corporation, Galt, Ont., have been given powers to increase their capital from $1,500,000 to $2,000,000.

Port Arthur, Ont.—The Western Drydock & Shipbuilding Co., of this city is filling an order for 15,000 shrapnel shells for the Imperial Government.

Order for Gun Cotton.—We understand that the Canadian Explosives at Nobel, near Parry Sound, Ont., have secured a large contract for the manufacture of gun-cotton.

F. W. Thorold Co., consulting engineers, Toronto, have been retained by the town of Port Hope, Ont., to prepare plans for a new sewage and sewage disposal system.

Lyddite Shell Order.—It is understood that the Record Foundry & Machine Co., Moncton, N.B., which recently received a big order for lyddite shells has closed negotiations for the purchase of the required machinery.

C. F. Todd, a Markham manufacturer, has received his third contract for army supplies, this time for artillery saddles. The contract calls for an expenditure of $7,500, and will be completed in a short time.

Campbellford, Ont.—The Government inspector was here recently and inspected the plant of the Dickson Bridge Works Co., with a view to the manufacture of shrapnel shells, and reported that everything is in satisfactory condition.

Errata.—In our description of the Quick Change Speed Sensitive Drill Press, which appeared on page 196 of our March 11 issue, the address of the Sipp Machine Co., was inadvertently given as Paterson, N.Y., instead of Paterson, N.J.

T. A. Willson & Co., Inc., Reading, Pa., manufacturers of eye protectors and goggles, were awarded a grand prize at the Second International Exposition of Safety and Sanitation recently held at the Grand Central Palace, New York City.

The Turbine Equipment Co., Toronto, have recently been awarded a contract by the town of Sydney, C.B., for the supply and installation of one De Laval 3½ million gallon centrifugal pump, direct connected to one 125 h.p. Canadian General Electric Co. motor, complete with C. H. Wheeler rotrex motor driven priming pump, etc.

Convention Notice.—The ninth annual convention of the Illuminating Engineering Society will be held at the New Willard Hotel, Washington, D.C., September 20-23 inclusive. E. S. Marlow, of the Potomac Electric Power Co., Washington, D.C., is chairman of the convention committee. The schedule of sessions, papers, etc., will be announced later.

Allison Contracts.—The Allison Supply Co. of Canada, announce that they have let contracts with United States manufacturers for 535,000,000 rounds of ammunition for the European Allies. The company has contracts pending for 500,000,000 additional rounds of ammunition. J. Wesley Allison, of Morrisburg, is stated to be the head of the company.

Artillery Equipment Orders. — The Dominion Chain Co., Niagara Falls, Ont. has received two large war orders, one from the British, and the other from the French Governments. The Falls plant will make buckles and other equipment for the British artillery forces at the front. The French Government has placed orders for a large amount of artillery hardware.

The Canadian Fairbanks-Morse Co., Toronto, have sold to the Water Commissioner of Port Hope, Ont., the following pumping units for the proposed waterworks extensions: One 10 h.p. oil engine, driving a 800-gallon centrifugal pump. The engine operates on distillate. One 600 gallon vertical, and one 250-gallon horizontal centrifugal pump (motor driven). F. W. Thorold & Co., engineers, Toronto.

Montreal ,Que.—An order calling for two million oat sacks and valued at $425,000 has been distributed among Canadian firms by Col. Barton, resident purchasing agent of the Imperial Government. Delivery of the material is requested to be made as quickly as possible, and Col. Barton stated that he expected immediate shipments of large quantities to go forward. The order for two million sand bags has not yet been placed as some further details from the War Office are being awaited.

Customs Revenue Decline.—The fiscal year, which ended on March 31, shows a decrease of $27,882,233.53 in the Customs revenue. The grand total was $78,261,535.41, as against $106,143,768.94 in the corresponding year. To the scarcity in ocean tonnage is attributed largely the falling-off of $646,521 in the March figures, though this does not account for the decline in imports from the United States. The revenue for the month was $7,356,125.21, as against $8,002,646.28 in March of last year.

Tariff Gossip.—Canada has raised the duty on machine tool imports from 27½ per cent. to 35 per cent. ad valorem. Why? Because in Canada, as in the United States, the demand for ammunition and other munitions of war has resulted in tremendous purchases of machine tools and the Dominion Government wishes to make it certain that as many of these tools will be furnished by Canadian manufacturers as possible. It is significant, also, that there has been no tariff agitation in Canada. Conditions simply were ripe for an additional duty and it was at once put into effect. We in the United States, says the Iron Trades Review, still have a few things to learn from our cousins across the border in quick, businesslike way of doing for the public.

Personal

Sir William Price has resigned from the post of president of the Quebec Harbor Commission.

A. S. Rendall, of St. John's, Nfld., has been appointed a director of the Nova Scotia Steel & Coal Co.

W. M. Weir, of Montreal, president of Canada Foundries and Forgings, Ltd., is leaving for Halifax to take a military course there.

John G. McBeath, for many years manager of the Woodstock, Ont., branch of the Canada Furniture Manufacturers, Ltd., is retiring.

Charles Warnock has been appointed manager and treasurer of Robert W. Hunt & Co., Montreal, succeeding Charles C. Whittier, transferred to the Chicago office.

J. W. Borden, accountant and paymaster-general of the Canadian Militia Department, and brother of Premier Borden, has been added to the membership of the Shell Committee.

Alexander Bower, who for over fifty-five years had been general superintendent of the Canada Sugar Refining Co., Ltd., Montreal, died on March 30. Mr. Bower, who was born in Edinburgh eighty-one years ago, came to Canada in November, 1834. He retired from the company two years ago.

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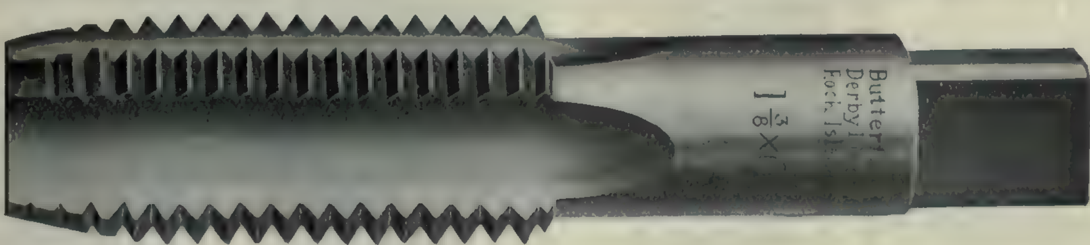
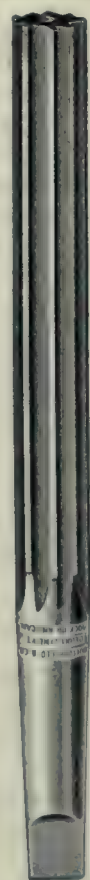




BUTTERFIELD & CO., INC. Rock Island, Que. and Derby Line, Vt.

George William Gaden, manager of the Gaden-Hillock Revolving Door Co., of Canada, died on March 31, at his home in Toronto. The deceased was born 73 years ago in St. John's, Newfoundland, and was a pioneer of revolving doors in Canada.

Martin Todd, of Galt, Ont., has been appointed, provisionally, to succeed W. P. Kellett, manager of the Lake Erie and Northern Railway, Mr. Todd is president and general manager of the Galt, Preston and Hespeler Railway. Mr. Todd has been directed by C. P. R. officials to investigate the advisability of electrifying the L. E. & N., in the event of which he will be retained as manager of both roads.

James Currie, marine engineer of 71 McGill street, Toronto, died on March 31. Mr. Currie was the son of James Currie, sr., who, with his brother, Neil, founded the Currie Boiler Works, now known as the Polson Iron Works. He was born Feb. 6, 1852, at Dundas, Ont., but came to Toronto when very young, practically all his life having been spent here. Mr. Currie was a member of the Marine Engineers' Association.

William Burrill, of the firm of William Burrill & Co., Yarmouth, N.S., died there on Friday morning, March 26 aged 74 years. Mr. Burrill was a native of Yarmouth, and, in the days when ship building in Nova Scotia was active, he and his firm were indentified with the industry, many fine craft being constructed in their shipyards at Meteghan and along the coast. Latterly the firm has been engaged in ship chandlery and outfitting business.

William Stitt, general passenger agent of eastern lines of the C. P. R., died suddenly on April 1, at the Windsor street station, Montreal. Mr. Stitt was born in Scotland in 1855, and came to this country as a young man. He joined the service of the C. P. R. in Winnipeg as a clerk in the passenger department in 1888. In 1901 he was given the office of general passenger agent for the C. P. R. in Australia. Six years later Mr. Stitt came to Montreal to take over the office of general passenger agent.

Railways—Bridges

London, Ont.—The contract for the new steel and concrete bridge over the Aux Sauble, at East Williams, has been awarded to D. Witherspoon for $6,600.

Calgary, Alta.—The construction of the Bassano-Coronation Railway, 110 miles in length, will shortly be commenced by the firm of Grant, Smith & McDonnell Co.

Toronto, Ont.—The Forest Hill Electric Bill, which was turned down by the Railway Committee of the Legislature on March 24, has been recommitted to that committee for further consideration.

Toronto, Ont.—The Dominion Railway Board has granted the application of the City of Toronto for the approval of its plans for the construction of a subway under the Grand Trunk tracks at the proposed extension of Wilton Avenue to connect with Dickens street.

Toronto, Ont.—Mayor Church states that "there is no hope of the railways starting the work on the new Union Station and the Esplanade viaduct." He has been informed that owing to the money situation it is impossible to finance the undertakings, which will have to wait until times improve.

N. T. R. Operation.—The first step toward State operation of the National Transcontinental Railway was taken last Saturday night, when Hon. Frank Cochrane, Minister of Railways, gave notice of a resolution authorizing the Government to lease or take over the Lake Superior branch of the G. T. P., extending from Lake Superior Junction to Fort William. The lease or acquisition of this line will include all terminal facilities and accommodation works. The resolution provides also for the purchase or lease of rolling stock and equipment, and provides that 'the G. T. P. Railway Co. and such other company shall be authorized on its part to deal accordingly with the said line of railway or terminal facilities,'' etc. The Government Railway Act will apply to all lines and facilities leased or acquired under this legislation.

Building Notes

Calgary, Alta.—It is announced that the government will shortly erect a Normal School building here.

Toronto, Ont.—The city will spend $70,000 for new buildings at the Canadian National Exhibition.

Brantford, Ont.—Brant County Council has decided to secure plans of a new Registry Office to cost $22,000.

Toronto, Ont.—A building permit has been granted to A. M. Wagstaff for an addition to a factory at 336 Greenwood avenue, to cost $3,000.

Toronto, Ont.—The Board of Education has obtained the necessary power to erect an Administration Building on College street. The building will cost $135,000 and will be 60 ft. by 90 ft., 4 storeys high.

Winnipeg, Man.—It is announced that the Oldfield, Kirby & Gardner Co., of this city, will erect a modern ten-storey office building. J. D. Atchison & Co., are the architects.

Miscellaneous

Canadian Pig Iron in 1914.—A number of blast furnaces were idle throughout the year. The manufacturers operating furnaces were the Dominion Iron & Steel Co., the Nova Scotia Steel & Coal Co., Algoma Steel Corporation, Steel Co. of Canada, Standard Iron Co., and Canada Iron Furnace Co.

Ottawa, Ont.—Fifty-seven rivers in Inland Canada now receive raw sewage from 159 municipalities, while the water supply of 111 places comes from sources above which sewage has been deposited. These facts will be set forth shortly in a report of investigations made by the Commission of Conservation. It will state, however, that conditions are improving, inasmuch as sixty-one sewage treatment plants are now installed in Canada.

New Incorporations

New Brunswick Canners Co. has been incorporated at Ottawa, Ont., with a capital of $10,000 to operate canning factories at St. Andrews, N.B. Incorporators: H. H. McLean, F. R. Taylor and H. F. Puddington, all of St. John, N.B.

Canadian Wallboard Co. has been incorporated at Ottawa, Ont., with a capital of $50,000 to manufacture and deal in wood fibres, pulp wood, etc., at Toronto, Ont. Incorporators: H. Riley, W. B. Sturrup and A. Bicknell, all of Toronto, Ont.

The Premier Electric Co. has been incorporated at Ottawa, Ont., with a capital of $40,000 to manufacture electrical machinery and supplies of all kinds at Montreal, Que. Incorporators: L. A. David, L. E. A. D'Argy Mailriot and S. H. R. Bush, all of Montreal, Que.

Bermite Explosives, Ltd., has been incorporated at Ottawa, Ont., with a capital of $200,000 to manufacture gunpowders and explosives of all kinds at Montreal, Que. Incorporators: C. W. Berry, of Waterloo, Que.; C. Watt, of Lachine, Que., and F. T. Enright, of Westmount, Que.

The Guelph Tire & Rubber Co. has been incorporated at Ottawa, Ont., with a capital of $350,000 to purchase the business and property of the Independent Tire Co. at Guelph, Ont. Incor-

porators: A. H. Davidson, of Southampton, Ont.; T. N. Dunn, of Strathroy, Ont., and A. Orr, of Toronto, Ont.

Catalogues

Semi-Muffle Furnaces for case hardening, annealing, carbonizing, heat treating, general hardening and heating work, are described in a bulletin issued by the Gilbert & Barker Mfg. Co., Springfield, Mass.

Flinn Steam Trap made by Richard J. Flinn, West Roxbury, Mass. The bulletin describes fully the construction and operation of the Flinn steam trap. The various conditions under which it can be used are given with a reference to its chief characteristics. A sectional view is included, showing the general construction of the trap.

Saw Sharpening Machines. Honeywill Bros., London, England, have issued a catalog dealing with an automatic saw sharpening machine, which is fully described and accompanied by a specification. The illustrations show the machine with the necessary attachments for grinding, circular, frame and band saws. A representative list of tooth profiles which can be sharpened on this machine is included among the illustrations. One view shows a machine sharpening a circular saw six feet in diameter.

A Study of the Malleable Furnace is the third of a series of booklets which have been issued by the Harbison-Walker Refractories Co., Pittsburgh, Pa. This is a most interesting and instructive volume, containing a fund of information on malleable practice, written in simple language. It aims to present the vital points in as clear and concise a form as possible, so that a fair understanding of the principles involved in connection with the production of malleable iron may be readily acquired by those not familiar with the scientific aspect of such work. The booklet contains six chapters, describing in a comprehensive manner the characteristics and properties of malleable iron and its manufacture. The micro-structure of malleable iron, also air and annealing furnaces are dealt with. The forty-nine illustrations consist principally of a

number of interesting photographs of fractures and photomicrographs. The booklet contains 112 pages and is a high-class production, being printed on coated paper and bound in attractive covers.

Steam Hammers.—The Chambersburg Engineering Co., Chambersburg, Pa., has sent us a copy of their new hammer catalogue No. 66, which describes in a comprehensive manner various types of steam hammers, also steam and board drop hammers. A detailed specification is given for each type, and tables are included giving the principal dimensions for each size. The hammers listed have capacities varying from 100 pounds to 20,000 pounds, thus giving a wide range and including types which would be suitable for any work where hammers would be required. A feature of this catalogue is the excellent illustrations, which show clearly the general design of the different types. A number of plates are included showing miscellaneous forgings made under Chambersburg drop hammers. The concluding pages deal with hammer details and their principal features, give directions for operating these hammers, and embrace a complete index of machinery built by the company. The catalogue is printed on coated paper and generally gotten up in an attractive manner.

Book Reviews

Sewage Disposal Systems in Canada is the title of an interesting brochure prepared by T. Aird Murray and T. Lowes, consulting engineers, Toronto. The book describes a number of sewage disposal plants of recent construction and also reviews the development of the septic tank. Various types of sedimentation tanks are also described. The book is fully illustrated and includes a number of photographs, plans and diagrammatic profiles of installations throughout the Dominion. The plants dealt with are all operating and have proved suitable for the climatic conditions.

Boiler Management and Inspection by Joseph G. Branch, 62 pages, 7½ in. x 5 in. Published by the Branch Publishing Co., Chicago, Ill. Price 50 cents. This is a new publication dealing in a simple manner with the design, operation and management of steam boilers. The book contains a series of 16 lessons in connection with which are a number of questions for each, bearing on the subject discussed in the lesson. The management, operation and inspection of boilers are dealt with in lessons 1 to 3. Lessons 4 to 8 deal with riveted joints and calculations of stays and braces. Safety valves are described in lessons 9 to 15, while lesson 16 is devoted to the subject of boiler scale and graphite. In addition to the questions already referred to are a series of Civil Service questions and answers. In a book of this description, these questions form a valuable feature, for they not only bring out the chief points in each lesson, but they also help the reader to a clearer understanding of the text. The book is thoroughly practical though more or less elementary in character. The apprentice, student, or even the operating engineer will find in its pages a great deal of extremely useful information, especially with regard to riveted joints and safety valves. The illustrations show a number of riveted joints and various types of these. The book is bound in stiff paper covers with table of contents.

Concerning the Selection of Suitable Gear Pitches

By John Edgar

Most of the manufacturers of gears possess a large number of mechanical text books and furnish a uniform set of rules and formulae for the proportions of the standard involute system of toothed gearing. These all, however, have their limitations, and have been trespassed by the demands of modern gear drives. Overcoming the difficulties is dealt with here.

DESIGNERS are now giving the gear question more study, and one point they can look into with profit is the interference of the teeth with one another. The automobile may be thanked for bringing this subject along with many others into prominence. The gearing of the automobile, next to the motor has received more thought than any other feature of its design. The limited space allotted the transmission necessitates the use of very small gears in proportion to the service they are called on to give. This calls for coarse pitches and gears of small number of teeth. In fact, the diameter is, in all cases, the minimum and in many less than the minimum diameter for the recognized standards of interchangeable gearing. To avoid interference as much as possible the newer stub tooth standard was brought into use. This system, with its short addendum and twenty-degree pressure angle, has reduced the interference to a minimum for any of the recognized standards.

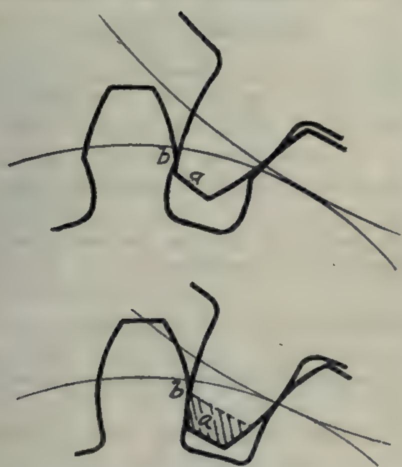


FIG. 1. INTERFERENCE OF TEETH OF GEAR WITH FLANK OF PINION AND ITS CORRECTION.

Geared drives are becoming numerous in the machine tool field and in this use also, compactness and smooth running are essential, both of which tend to make the design of the teeth of primary importance. The range of speed ratios required by this line is much greater than in the automobile, and the gears are more numerous. The special grades of steel developed for the automobile are adaptable to the machine tool as well. Noise in the olden days was considered one of the accompaniments of the tooth gear, and was not heeded. All this is changed for, at the present time, in the construction of high grade cars, gears that utter the faintest murmur are rejected. The gear that has been produced under proper conditions will run quietly if the tooth curves are correct and the number of teeth chosen to avoid interference.

Interference.

Interference, is the common fault of noisy gears. Unless avoided, the greatest care in the forming of the tooth curve will be of little avail. There is a well defined law in odontics that must be obeyed in order that the teeth clear one another and roll together with a uniform motion. It should be the aim of the designer to obey this rule, and he can do so by a careful study of the subject. The reason why designers have not given the subject particular attention along practical lines is the fact that the tooth curves have all been made to a system that has long been accepted as the standard and from which it has been hard to deviate. The automobile, however, has revolutionized this and we now are in the way of having a standard adopted that will give better results in a wider field than the old system was capable of. The modern systems of generating the teeth of the gears leaves the problem open for more independent rsearch in this field than when we were confined to the older formed cutter methods. Many designers of machinery, dependent on gears to a large extent, have a very hazy idea of the theory or practice of tooth gearing beyond the mere knowledge of the rules for finding the diameters.

The manufacturer of gear cutters has taken care of the interference of the teeth in the best manner possible for him. Besides limiting the range of the number of teeth to be cut with a single cutter, he has corrected the curves to the extent necessary to avoid interference as much as possible. The range of the standard set of cutters is from 12 teeth to the rack. That the interfer-

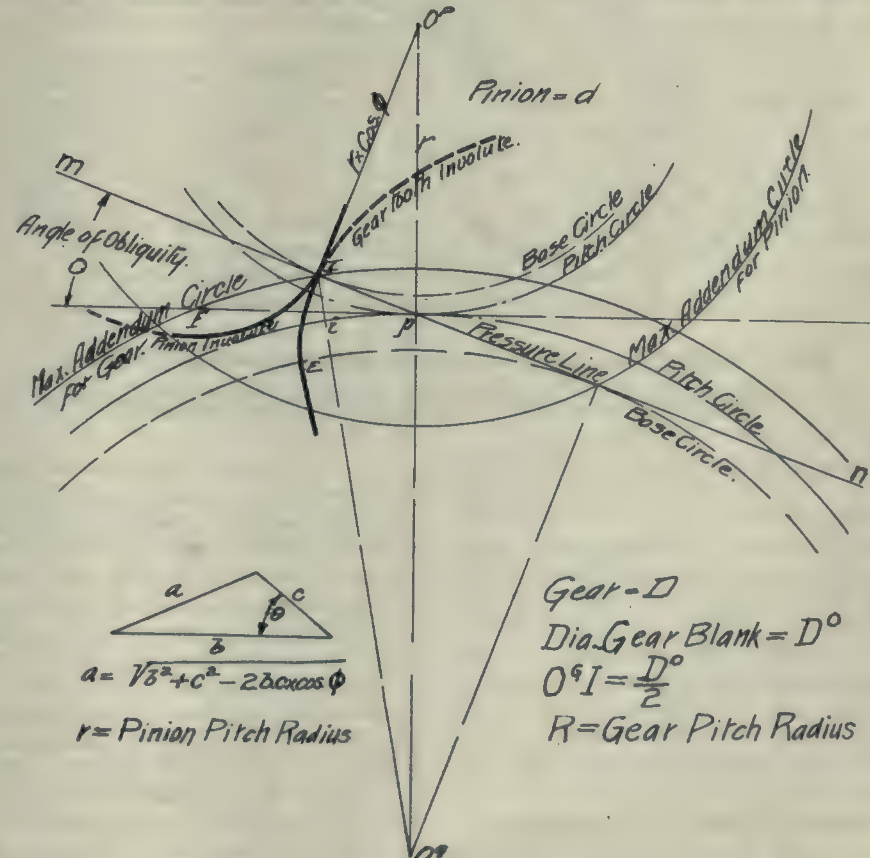


FIG. 2. FUNDAMENTALS IN THE PRODUCTION OF TOOTH CURVES.

ence is between the point of the tooth of one gear and he flank of the tooth of the mating gear is generally known, and 30 teeth is commonly accepted as the smallest number of teeth for a gear in which interference is to be avoided. This is truly the case when we have the higher number of teeth meshing with the 30-tooth gear, such as the rack, and the interference is gradually decreased until it disappears when we reach the lower numbers of teeth. It is the object of the writer to show how by a proper selection of pitch, gears may be proportioned for any given ratio to avoid interference.

The interference of the teeth of two gears in mesh is illustrated in Fig. 1. The point of the tooth (a) is seen to be hooking into the flank of the mating gear near the base line at (b). The result of this hooking action is the rapid wearing of the teeth at these points, and the weakening of the teeth very near the root. This interference may be so bad as to spring the tooth under heavy loads. The intermittent straining has a tendency to crystalize the metal and eventually the tooth will break out. It obviously requires extra power to cause the tooth to ride over this point of interference which, though a small item in a single pair of gears, is worth considering in a system of several trains, even should the wear not be taken into account.

Removing Cause of Interference.

It is quite evident that this interference can be avoided by removing the part of the tooth (a) that projects above the point of interference. This is commonly accomplished to a certain degree by pointing the tooth from the point (a) out. This altering of the curve causes a back lash between the teeth and will result in hammering and squealing. If the pair of gears were to be designed with reference to the avoidance of the interference, and the pressure angle were to remain the same, the diameter of the blank would be reduced so that the tooth would not extend beyond the point (a) Fig. 1. If it were desired to use standard cutters, the pitch would have to be chosen accordingly.

In order that the following matter may be more easily grasped, we will refer to the diagram Fig. 2. This is to show as simply as possible, the method of arriving at the construction of the fundamentals of a pair of gears. The centres of the pinion and gear are designated by O^p and O^q respectively, the pitch circles of each being tangent at the pitch point (p). The base circles of the gear and pinion are drawn tangent to the pressure line, which crosses the pitch point at an angle O. The angle of obliquity O, being that for the involute system chosen. From the centres of the gear and pinion respectively, and perpendicular to the line of pressure (mn), also intersecting the base circles at the point of tangency, a line is drawn in each case. The points of intersection of these perpendiculars with the base circles are the **interference points.** At this point (I) for the pinion, the teeth of the gear cease to roll on the teeth of the pinion, but commence to hook into the flanks of the pinion teeth. The position of this point limits the diameter of the gear, and the distance O^g. I. is the limiting radius of a gear blank, or addendum diameter that will mesh with this pinion without interference. From this point out the curves of the teeth of the pinion cross those of the gear, and if the diameter is not reduced, the tooth curve must be changed from the involute.

The same construction applies in the case of the pinion as for the gear, and it will be seen that the limiting addendum circle is much larger in proportion for the pinion, than for the gear. From this it is seen that, if the gear be made so that it will not interfere when the standard addendum of $\frac{1}{P}$ is used, the teeth of the pinion will not interfere with the flanks of the gear.

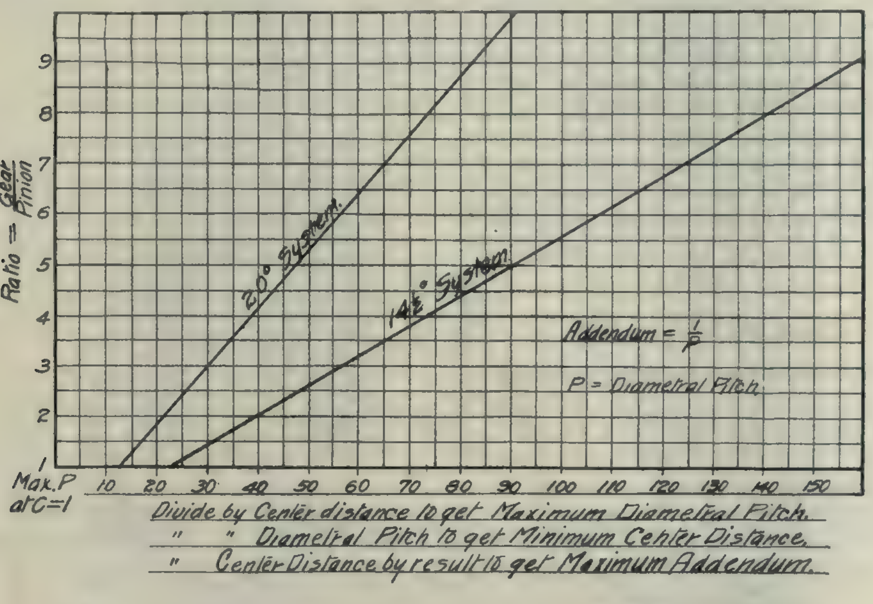


FIG. 3. GEAR CHART FOR DETERMINING PITCH, CENTER DISTANCE AND ADDENDUM; RATIO OF GEAR TO PINION BEING KNOWN.

Dimensions of Blanks.

The problem becomes simply that of finding the diameter of the addendum circle that intersects the interference point I, the radius of which is $\frac{D^{\circ}}{2}$, Fig. 2. We know the distance between centres of gear and pinion which we call (c) and the ratio of gear to pinion $\frac{D}{d}$, from which we can find that the pitch radius of the pinion r, $= \frac{c}{1-R}$ where R is the pitch radius of the gear. The radius of the maximum addendum circle of the pinion O^pI, is r × cos O. The problem now resolves itself into solving the obtuse angled triangle O^p O^g I to find O^gI and O^pI which may be done by the formula,

$a = \sqrt{(6^2 + c^2 - 2bc \cos O)}$. See diagram. Fig. 2.—Inserting values, we get

$$D^{\circ} = \sqrt{c^2 + \left(\frac{c}{1-R} \cos O\right)^2 - 2c \left(\frac{c}{1-R} \cos O^2\right)}$$

$$= 2\sqrt{c^2 + \left(\frac{c}{1-R} \cos O\right)^2 - 2\left(\frac{c^2}{1-R} \cos^2 O\right)}$$

D° is the outside diameter of the blank and D is the pitch diameter, so that the addendum is $\frac{D^{\circ}-D}{2}$. The diametral pitch P is the reciprocal of the addendum and is therefore $P = \frac{2}{D^{\circ}-D}$ which becomes after substituting the value of D°,

$$P = \frac{2}{\left[2\sqrt{c^2 + \left(\frac{c}{1-R} \cos O\right)^2 - 2\frac{c^2}{1-R} \cos^2 O}\right] - D}$$

There are two systems of involute gearing, one with the angle of obliquity

at 14½° and the other having it equal to 20°. Inserting the values of cos θ in the above formula we get, for the 14½° system,

$$P = \frac{2}{2\sqrt{\left[c^2 + \left(\frac{.968\ c}{1-R}\right)^2 - \left(\frac{1.878\ c^2}{1-R}\right)\right]}}$$

and for the 20° system,

$$P = \frac{2}{2\sqrt{\left[c^2 - \left(\frac{.94\ c}{1-R}\right)^2 - \left(\frac{1.766\ c^2}{1-R}\right)\right]}}$$

Plotting the Curves.

By taking the centre distance (c) as equal to 1, we can calculate a series of values of P for various values of R and, from the results plot a curve. This has been done in Fig. 3 for both the 14½° and 26° systems for values of R ranging from 1 to 10. By dividing the resulting values of P, for any ratio, as obtained from the chart by the centre distance in inches we get the maximum diametral pitch possible with that ratio without interference.

The relative positions of the curves on the chart explain why there are so many that advocate the 20° system in place of the 14½° system of tooth curves. The 20° involute affords a greater range of ratios without interference than the 14¼° involute, so commonly used.

The 20° curve in the chart is applicable to the "Fellows stub tooth system" also, by using the addendum pitch number of the combination as the pitch chosen from the chart and then spacing the teeth with the spacing pitch number, as follows; ratio 4 to 1 at 5" centres, entering the chart at the horizontal ordinate corresponding to the ratio, and following it to the intersection with the 20° line and read the vertical ordinate, 38, which divided by the centre distance gives the maximum diametral pitch which is 7.6P or 8P as the next smaller whole pitch should be used. In the Fellows system the larger number represents the addendum number so we would choose, in this instance, the 6-8 pitch. The sum of the diameters of the two gears is 1 + 4 = 5" and the number of teeth in the two gears would be 6 × 5 = 30. The gear having $\frac{4}{5}$ of 30 or 24. and the pinion, 6 teeth. This is evidently an impractical combination.

If the gears in the above example were made to the standard addendum, the pinion and gear would then have 8 and 40 teeth respectively. The pinion has too few teeth to be practical with the standard addendum, it being too short to give continuous motion and could not be produced by standard cutters or hobs. Twelve teeth is the accepted minimum in practice although, in special cases, the number can be reduced to 10 or even 9 teeth if the motion is not to be of a positive character. When the number of teeth in the pinion is below the minimum the only recourse is to increase the centre distance or to reduce the pitch of the teeth. If the former is decided upon, the method is as follows; the pinion must have at least 12 teeth and, as the centre distance is in the inverse ratio to the pitch number, we would get for our corrected distance, $\frac{12}{8} \times 5 = 7.5$ in. The pitch would still be 8.

As another example, take the same ratio and centre distance but the 14½ degree system: The chart gives 74 as the pitch for one inch centered distance which, divided by the centre distance 5, gives the maximum pitch as 14.8, or say 15. The number of teeth in the pinion figures out to 18.75 teeth. This pitch may be too fine and it may not be convenient to increase the centre distance in order to increase the pitch. We may, however, increase the pitch by reducing the number of teeth in the pinion, but this again, will cause an interference between the teeth. To avoid this interference we may make the diameter of the gear blank equal to the outside diameter of a gear of the pitch obtained from the chart and cut the teeth of a coarser pitch making them shallower by one-half the reduction in diameter, providing we do not make the pitch such that the distance i,p, Fig. 2, is not less than the circular pitch of the tooth. If it were, the action would not be continuous as one pair of teeth would go out of action before the next engaged. It would not be necessary to make any change from standard in the diameter of the pinion the diameter being calculated from the selected pitch.

On the other hand, if we have a ratio to satisfy and wish to use gears of a certain pitch, we work as follows: The rule on the chart is divide the pitch for one inch centre distance as found for the ratio by the diametral pitch, it is desired to use, and the quotient is the centre distance in inches. Thus for example, if we have a ratio of 4 to 1 to satisfy and wish to use gears of 4-pitch (14½ deg.) the centre distance will be 74 ÷ 4 = 18.5 inches. If we wish to avoid interference between the meshing teeth, the pinion would have 2c × 4 ÷ (1 + R) = (2 × 18.5 × 4) ÷ (1 + 4) = 29.6 teeth, c being the centre distance and R the ratio.

As has been stated in the foregoing part of the article, the curve of standard gear cutters has been corrected to avoid the interference but even then the teeth of the gears that are within the prohibited range will bear harder on one another than they should and to get the best results, the combinations should be designed according to the chart with numbers of teeth that will insure the avoidance of interference. The gears will run smoother, can be meshed with less back lash, and will wear longer and require less power to run.

Comparison of Systems.

The days when noisy gears will be tolerated is past now that it is generally known that quiet gears are a practical possibility. The general user of machinery is now so well acquainted with the automobile that he wants as high grade workmanship in every piece of machinery he puts his money into, knowing that the longer life and lower upkeep will compensate for any reasonable increase in the first cost. The power consuming and destructive qualities formerly attributed to gears has long been shelved by those who pretend to be up-to-date.

The question of tooth interference must not be lightly treated if we are to have the success that we expect with the gear train because this interference is not only a hindrance to quiet running but imposes a destructive wear on the teeth themselves: The vibrations set up by the intermittent hammering of the interfering teeth is not only destructive to the tooth surface, but is transmitted to the other components of the mechanisms and has a tendency to disintegrate and loosen fastenings. This vibration also has a tendency to disrupt the film of oil in all the bearings making it difficult to maintain a proper lubrication of the whole system.

When it is impossible to comply with the requirements of the charted quantities, and the case warrants the expense, the interference may be conveniently avoided by a change in the pressure angle of the teeth, or by altering the addendum as already pointed out. This change in the addendum has been taken advantage of in the design of some bevel gear drives for automobiles. In fact we may say that it is now the universal way of making these gears, the addendum being very much reduced below the normal in the case of the gears and increased in the case of the pinions to make the whole depth the same as the present standard, although there seems to be no particular reason for doing this. The more logical way to do would be to make the depth special to suit each particular case.

We shall, no doubt, continue to have those noisy gear drives with us but in the finer mechanisms, the care and time necessary to obtain noiseless gears is

well spent. It is better to avoid incorrect combinations than to make corrections and alterations in order to make the wrong combination pass. If, in mechanisms, it is found that the high ratio desired cannot be obtained with but one train of gears the reduction is much better made with two or more trains than to make one train that will not make a quiet running combination.

RAILROAD ENGINE HOUSES.

THE American Railroad Engineering Association, through its Committee on Buildings, has issued the following report relative to engine-house design and equipment features:—

Form.

(a)—The circular form is preferable.

(b)—At points where not more than three or four locomotives are housed at one time, and where it is more economical to provide a Y track than a turntable, or where it is not necessary to turn locomotives, a rectangular house, either with through tracks or with switches at one end only, may be desirable.

(c)—At shops where a transfer table is used, a rectangular engine house served by the transfer table may be desirable.

Turntable.

(a)—The turntable should be long enough to balance the engine when the tender is empty.

(b)—A deck turntable is preferable to a through table.

(c)—At important terminals, turntables are most economically operated by mechanical means. Where few and light engines are turned, hand operation may be desirable.

Where electric power can be obtained at a reasonable cost, an electric tractor is the most efficient means for operating a turntable, the cost of power is cheaper, and it is superior in continuity of service and maintenance. The first cost is approximately the same as an air motor of equal power and size.

Power wires are brought to table by either the overhead or the underground method. An overhead device has the advantage of accessibility for inspection and repair. Special care must be taken to properly protect collector head from weather and gases and support collector rigidly (framework supporting same should be fastened to steel frame of table and not to ties, and must be securely braced). The wires should be large enough to keep them from breaking from sleet and should be supported to framework supporting collector. Any play at table multiplies at collector head. Wires should be brought to pole, close to curb of turntable, keeping lines as far distant from nearest wall of roundhouse as possible, to minimize the danger of destruction by fire.

When the underground system is properly installed, its advantages are that all exposed non-current carrying parts are permanently grounded, including the circular-track rail (the only part of system to repair is collector head); non-interference from weather if turntable pit is properly drained.

The disadvantages are: The wire is not so easily repaired, and is much more difficult to originally install, as it must be properly protected from water, and cannot be successfully laid in a fill or on ground where settlement or shifting takes place. Where turntable pit cannot be well drained, it cannot be used with success. It has the advantage of protecting power to run table in case of fire to roundhouse, especially in one of a nearly complete circle.

Compressed air tractors are frequently used. Ordinarily the power costs much more than electricity and is not so reliable. At points having no power plant the locomotive to be turned furnishes the compressed air; in this case an auxiliary supply should be maintained by providing a small air tank, secured to the turntable for operating it before or after the engine is placed.

(d)—The deck on turntable should be wide enough to provide a walk on each side and be protected with hand rails.

Turntable Pit.

(a)—The turntable pit should be well drained and preferably paved.

(b)—The circle wall should be of concrete or brick, with a wood coping not less than 6 ins. thick.

(c)—The circle rail should preferably bear directly on concrete base. The use of wood ties and tie plates supported by masonry is desirable under some conditions.

(d)—Easy access to the interior of a turntable for the oiling of bearings, painting and inspection should be provided in the design of the turntable pit, unless ample provision is made in the turntable itself.

Door Openings.

The clear opening of entrance doors should not be less than 13 ft. in width and 16 ft. in height.

Doors.

Doors should be easily operated, fit snugly, be easily repaired and maintained, and should admit of the use of small doors.

Tracks.

(a)—Lead tracks to the turntable should line up with tracks of the engine house where possible.

(b)—Tracks should be on a level grade and should be provided with stop blocks.

(c)—Special fastenings of the track rails at the circle wall and on the turntable are desirable to prevent movement of the rails, to give good bearing, and to lessen the damage from derailed wheels.

Position of Locomotive.

In a circular house, the locomotive should stand normally with the tender toward the turntable.

Length of House.

The length of stall along centre line of track should be at least 15 ft. greater than the overall length of the locomotive, to provide a walk-way behind the tender, a trucking space in front of the pilot and a certain distance in which to stop the locomotive or to move it to bring side rods or other parts into convenient positions.

Materials.

(a)—The material used in construction of the house should be non-corrosive, unless proper care be taken to prevent corrosion.

(b)—The additional security against interruption to traffic from fire warrants serious consideration of the use of a fireproof roof, and dividing the engine house into units of approximately ten stalls by the use of division walls built of fireproof material.

(c)—When the roof is of reinforced concrete the columns and roof beams should be of the same material.

(d)—Reinforced concrete should be used for the walls only where special conditions reduce its cost below that of brick or plain concrete, and should not be used for that portion of the wall directly in line of track where engine is liable to run into it.

Engine Pits.

Engine pits should be not less than 60 ft. in length, with convex floor, with drainage toward the turntable. The walls and floors may be of concrete. Proper provision should be made for the support of the jacking timbers.

Smoke Jacks.

The smoke jacks should be fixed. The bottom opening should not be less than 42 ins. wide and long enough to receive the smoke from the stack at its limiting positions, due to the adjustment of the driving wheels to bring the side rods in proper position for repairs. The bottom of the jack should be as low as the engines will allow, and it should be furnished with a drip trough. The slope upward should be gradual to the flue. The area of the cross-section of the flue should not be less than 7 sq. ft., and the jack should be made of non-combustible material. (This design of jack applies to all houses where regulations will per-

mit. In some cities, where smoke abatement laws are in force, special design of jacks are necessary.

Floors.

The floor should be of permanent construction, and should be crowned between pits.

Drop Pits.

Drop pits should be provided for handling truck, driving and trailer wheels.

Heating.

(a)—Heat should be concentrated at the pits. The outlets should be fitted with dampers, so that heat can be cut off while men are working in the pit.

(b)—The general temperature of the engine house should be kept between 50° and 60°.

(c)—The recommended method for heating is by hot air driven by fans through permanent ducts, which should be under the floor, where practicable. The fresh air supply should be taken from the exterior of the building and no recirculation allowed. It should be delivered to the pits under the engine portion of the locomotive. It should be heated as far as possible by exhaust steam, supplemented, as required, by live steam.

Window Lights.

(a)—The disadvantages of skylights are so much greater than their advantages as to make them undesirable.

(b)—Windows in the outer walls should be made as large as practicable with the largest glass or light area consistent with the requisite strength. In general, the lower sill should be not more than 4 ft. from the floor, and only sufficient space left between pilasters and sides of window frames and girders and window heads to properly secure the window frames. Windows or transoms as large as practicable should be provided over all doors where locomotives enter. Window lights in doors are objectionable on account of difficulty of maintenance.

Electric Lighting.

General distribution of illumination should be provided between pits by arranging a number of lights to avoid shadows and to give good light for workmen at the sides of the locomotives. There should be plugged outlets for incandescent lamps in each alternate space between pits.

Piping.

(a)—The engine house should be equipped with piping for air, steam and water supply, and where desired, piping for a washout and refilling system should be installed. Where this system is installed, the blow-off lines should be led to a central reservoir; where this is not used, the blow-off lines should be led outside the house.

(b)—The steam outlet should be located near the front end of the boiler. The blow-off pipe, the air, the washout and refilling water and the cold water connections should be near the front end of the firebox.

Connections need only be provided in alternate space between stalls.

Tools.

There should ordinarily be facilities provided for hand tools and for the location of a few machine tools, preferably electrically-driven.

Hoists.

Hoists with differential blocks are generally used for handling heavy repair parts, and suitable provision should be made for supporting them.

SAFETY FIRST.

IN spite of all that has been written concerning the origin of safety movement, it will interest manufacturers to know that the earliest record of systematic eye protection is that of the Crane Co., Chicago, who in 1897 began to provide eye protectors for its men, and in 1898 put this work on a systematic basis, giving the glasses to the men free of charge, and requiring operators, as far as possible at that time, to wear the glasses constantly when they were exposed to flying bits of metal, emery, dust, glare and hot metal.

Dr. A. M. Harvey, who at that time was and still is their chief surgeon, was the originator of this plan of providing glasses for the men, and the fact that since they have been providing glasses, their eye injuries have been cut down to an extremely low point, proves the value of having workmen protect their eyes in the shops. The Crane Co. posted signs conspicuously at various points in the shop drawing the attention of the men to the necessity of using glasses, and to the fact that the glasses were being provided by the company free of charge. This corporation is one of the foremost in the safety movement

SHRAPNEL SHELL MACHINING DEPARTMENT OF A LEADING CANADIAN ENGINEERING ESTABLISHMENT.

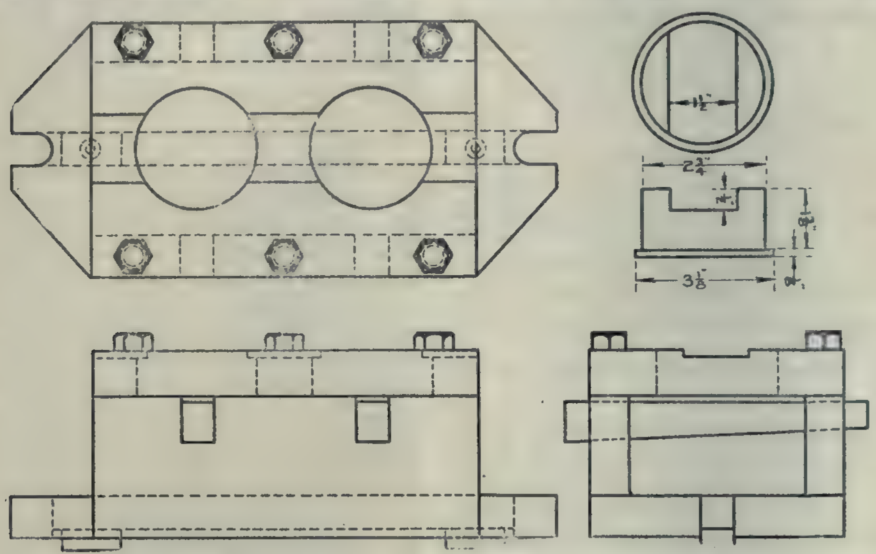
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A MILLING FIXTURE.

By D. S. Mann.

THE dimensioned piece shown in the accompanying sketch is of cast iron, and is used in the construction of an oil engine governor. After being turned, the 1½-in. slot is



MILLING FIXTURE FOR OIL ENGINE GOVERNOR DETAIL.

milled for the governor arm. These are held two at a time in the fixture shown. The top of the fixture is bored to receive the two pieces, being machined on the under side, and held to the main body by the six cap screws. The pieces are slid in from beneath and the wedge driven in to hold them securely. As the cut is being taken on the first, the second is put in place.

The holes in the top plate are slightly bell-mouthed below, so that the pieces enter easily. The top plate was not finished on the upper surface, and was left slightly thicker than necessary in order to mill a slot cut through the middle. This served for setting the cutter both central and for height, giving the proper depth of slot.

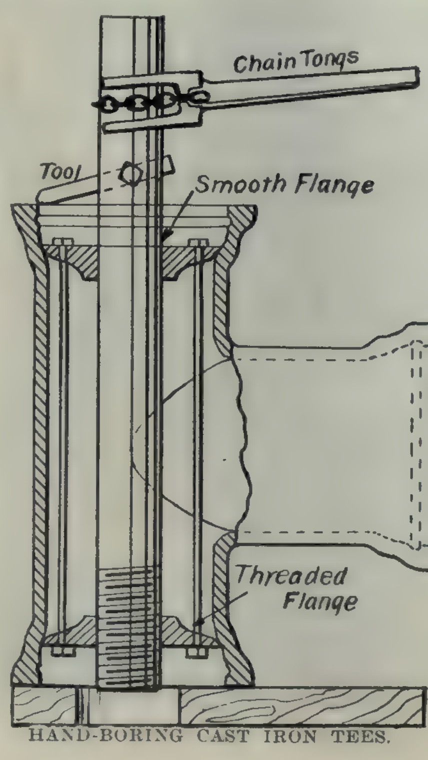
INGENIOUS WAY OUT OF A DIFFICULTY.

By F. A. MacLean.

THE accompanying illustration will serve to explain a peculiar mechanical difficulty and one man's way out. The method of solution, while not strictly original, will lend itself to a great many emergency jobs. It is, perhaps, not too much to say that the man who can do things without tools is, so to speak, getting to be more and more of a rarity.

There were two 8-inch bell-end cast iron tees which were to be used in conjunction with thin steel, spirally riveted water pipe. There was also some standard wrought iron pipe to be used up, and when the pipe was placed into the bell of the tees, it was found that there was not enough room left to make a satisfactory lead joint.

As we had no other tees on hand and no other pipe that we could use, it looked as though we would either have to order new tees or send those we had



HAND-BORING CAST IRON TEES.

to a machine shop to be bored out. Either alternative meant considerable expense and several week's delay which could be ill afforded at the particular time of the year. The writer proposed to the engineer in charge of the work that the tees be corrected on the job and after obtaining that worthy's more or less incredulous consent, the work was accomplished in the following manner:

Two 3½-inch flanges were procured. One was filed smooth, in place of the thread, so that a piece of 3½-inch pipe would work easily in it without play. The flanges were about 7¾ inches outside diameter and fitted nicely in the bottom of the bells of the tees, which were about 2½ inches deep. After being centred, the flanges were drawn up tight by means of two long bolts as shown. The casting was then clamped to a couple of two-inch planks by means of two short bolts through the two remaining holes in the bottom or threaded flange.

For a boring bar we used a piece of 3½-inch pipe of convenient length. After cutting a long thread on one end, a hole was drilled for the tool a distance from the threaded end, such that, when the thread was well started in the bottom flange, the tool was just starting to cut in the top end. After spiking the two-inch planks firmly to a couple of heavy timbers, a large pipe tongs was attached to the top end of the pipe and two men walking around in a circle easily furnished the drive. The cut was regulated by tapping the tool out with a hammer, and the pitch of the screw furnished a very suitable feed.

After once getting started, the job was finished in remarkably quick time. The ends were bored out two inches deep which gave ample room to make a good lead joint. Very little time was lost and the cost was about equal to that of the transportation of the castings to the nearest machine shop.

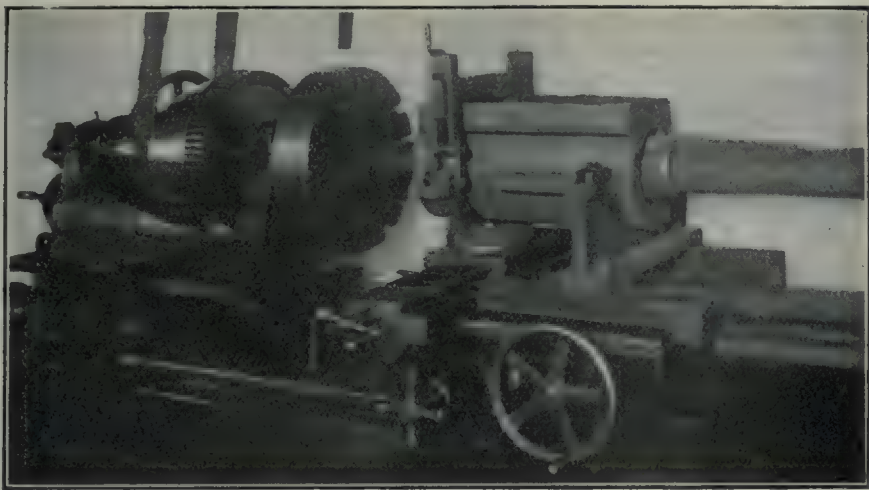
CAST IRON BORING BARS.

By D. O. Barrrett.

IN the modern machine shop of to-day, wherever possible, cast iron is being replaced by steel, as being more durable, and also stronger and stiffer. However, in the accompanying photograph is shown a cast iron boring bar which is doing good service on gasoline engine cylinders. This is rather a curiosity for a good many machinists, and the writer himself was somewhat surprised at the

quality of the work done with a bar of this kind.

The gasoline engine cylinders range from 5 to 10 inches in diameter, and the bars average about 5 ft. in length. They are reinforced by a double ring in the centre with three tapered ribs running up to the same. As will be noted, the bars were placed between centres, and the chuck jaws run down on same. Three tools were used in the first and second boring operation, while the final cut was taken with a single tool. These bars were remarkably stiff and performed their work in a very satisfactory manner.



CAST IRON BORING BAR EQUIPMENT.

THE MOULDING MACHINE.

By M. O. S.

WHEN the moulding machine was first put on the market, it was regarded as a hugh joke by the moulder, and although up-to-date foundry men admitted that it was an artistic piece of machinery, there were very few who considered it practical. As time went by, however, and the moulding machine continued to gain ground and become more perfect in its output, some of the more wide-awake foundrymen began to sit up and take notice, for it looked very much as if the machine had come to stay. The rapid developments in the last few years have proved its efficiency and sufficiency beyond a doubt. It is now possible for the foundryman to produce moulds by machinery for almost any casting that can be made in a two-part flask.

No machine ever invented had a harder fight to make good than the moulding machine, for the moulders "knocked" it and did everything in their power to discourage its use. This was a great mistake on their part, for if they had accepted it and given it a fair trial, the handyman and machine operator would never have had the same footing in the foundry as they hold to-day.

The Accuracy Feature.

That a moulding machine is more accurate in duplicating work than a moulder goes without argument, as no two moulders rap or draw their pattern the same way. A machine-made mould is always the same size, providing it is made by a careful operator. This is an advantage that lots of foundrymen have never considered, and thousands of pounds of metal are wasted annually from castings being over-weight.

We hear many reports about big discounts and scrap in machine moulding, but, when this is traced back, the real cause of these troubles is usually carelessness in making or handling the moulds and not by the failure of the machine to do its work. The one thing that is essential to make machine moulding a complete success is to secure first-class operators, see that these men are instructed in how to temper the sand for the different classes of castings, and also are shown how to ram and pour the different work. Unless these three points are drilled into a green man's head, you will have very little success, and a little time and patience with a new man on the job will give you good returns. In most cases where the results with a moulding machine have not been satisfactory, the machine gets the blame, when the truth of the matter is that the operator has never had the proper instruction that is necessary to a new man on this line of work.

Selecting a Moulding Machine.

When buying a machine, if there is any doubt in your mind as to the successful production of any class casting, it is wise to consult a reliable manufacturer, for every man who makes these machines understands that the reputation of his product depends upon the accuracy of his judgment on this point. His opinion is, therefore, valuable. Another question to be considered in buying a moulding machine, is whether it will pay a sufficient return on the money invested.

A very important detail in connection with the making of moulds by machinery is that there is not nearly as much expense required to keep the patterns in repair, as the pattern plates are not subject to as much damage as the gated pattern, when it is used in a sand or clay match or follow-board.

The Output Feature.

The main advantage of producing castings on the moulding machine is the great increase in output. This is many times that of the moulder. There are numerous other ways in which it is a great boon to the foundryman. It gives him good, uniform castings without high priced skilled labor; the latter being sometimes difficult to get. The best proof that the moulding machine has come to stay is that on investigation it will be found that the largest and most up-to-date foundries in both the United States and Canada have hundreds of them in operation, and are not only satisfied with the results obtained from them but are installing more from time to time.

MAIL MATTER WAR TAX.

THE Post Office Department having given notice a week or two ago in connection with the War Revenue Act that all letters and postcards mailed in Canada for delivery in Canada, the United States of Mexico, and letters mailed in Canada for delivery in the United Kingdom and British possessions generally, or wherever the two-cent rate applied, should in addition to ordinary postage carry a one-cent stamp as a war tax, and also having notified the public that such war tax, while it should be paid preferably by the postage stamp marked "war tax," could, if such stamp were not available, be paid by an ordinary one-cent postage stamp, is now issuing further notice to the effect that postage stamps may be used for the prepayment of war duties on bank cheques, bills of exchange, promissory notes, express money orders, proprietary or patent medicines, perfumery, wines or champagne, as well as upon letters and postcards, postal notes and post office money orders, the intention being to provide facilities in those portions of the country where excise stamps are not readily available. This, in view of the fact that postage stamps may be obtained at all points over the whole country, and in many places where there is no collector of inland revenue, and where no inland revenue stamps could be obtained, is a distinct convenience to the public, and no doubt will be largely taken advantage of.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

CONCERNING CORE COMPOUNDS.

By "Melter."

CONDITIONS under which core compounds are selected do not appear altogether satisfactory, either from the standpoint of consumer or from that of the producer. This, however, is not surprising as the materials involved differ greatly in composition and are subject to varied applications.

Cores are of two kinds—green sand and dry sand. Those of the former will not be considered here as they do not require compounds to create binding power but rely altogether on the shape of the grains of sand.

The Sand Feature.

The suitability of a core for any special line of work depends largely on the nature of the sand and binder mixed with it. The chemical composition, the degree of fineness and shape of grains of sand are all-important factors. A sand high in alumina will bake harder than one with a smaller percentage of alumina and the harder condition would be detrimental to good venting. The coarser the sand, other things being equal, the greater will be the strength, at least up to a certain limit.

Organic matter gives bond, but burns out when molten metal comes into contact with it, causing the core to fall or crumble. For this reason, river sands are better than bank sands as all foreign matter is washed out. Iron, manganese, magnesia and lime are all detrimental, and have the effect of causing the core to crumble as already noted.

A medium coarse grade of sand should be used, say, with a degree of fineness of from 55 to 75. A grade coarser than this does not permit of its voids being all filled by the binder, and the result is a weak core. For instance, a 35 grade sand when new was 40 per cent. weaker, comparatively, when mixed with the same proportion of compound, sand and clay wash, and baked for the same length of time and at the same temperature as a 50 grade sand. The degree of fineness of a sand may be found from a sieving test by multiplying separately the number of grains passing through each sieve by its mesh number, adding the results and dividing the whole by 100. Sieve meshes of 100, 80, 60, 40 and 20 are used.

The most convenient way is to weigh out exactly 100 grains of sand, sift for one minute on the 100 mesh sieve, weigh what goes through, sift the balance on the 80 mesh sieve for one minute, and so on. Any loss is counted on the 60 mesh, and what does not go through the 20 mesh is credited to the one mesh sieve. If the sand is very fine, more binder will be required and a close hard core with poor venting will result. It is possible to use 85 per cent. old and only 15 per cent. new sand and get good satisfaction. If machine mixing is practical, more old sand can be used than when mixing is done by hand.

It is not beneficial, however, to run up old sand much beyond 85 per cent. Used sand has the alumina (clay) burned out, and each grain of silica has a coating or film of carbon around it. This film of carbon does not permit the binding material to be as effective as it would be if new sand were employed. If there is much fine sand in the old, more binder will be required as the dust needs as much binder as is necessary for the grains.

Core Binders.

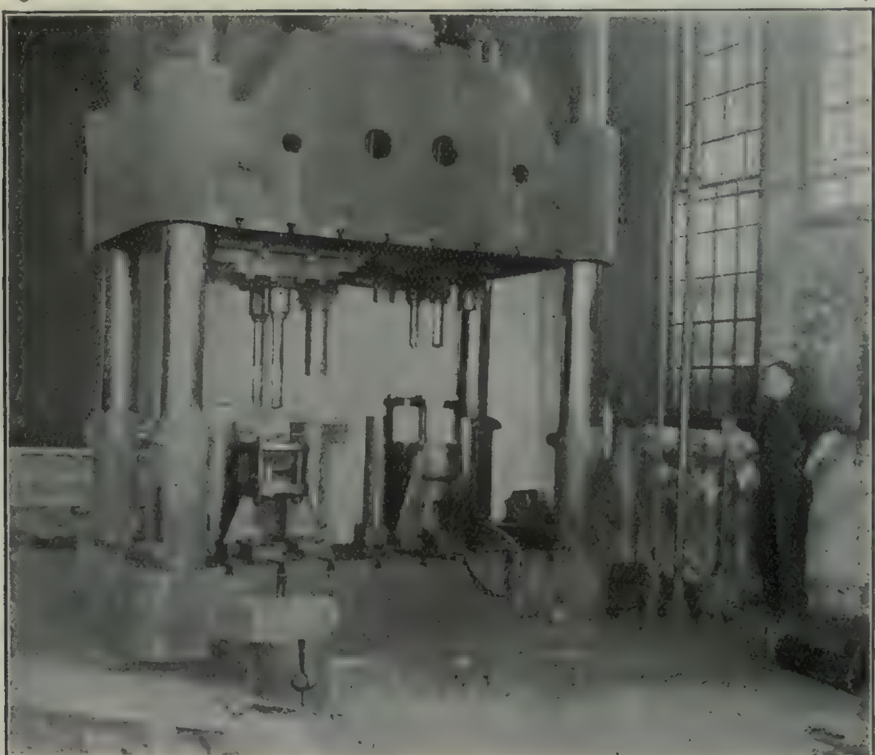
Core binders may be divided into four groups—dry compounds, oil, paste, and those which are capable of being dissolved in water.

Flour.

Flour is a paste binder. It burns out easily and is, therefore, good for long thin work, although it has very little green binding power. The core should be used almost immediately, as moisture is taken up from the air and moulds.

When using flour, a good brand should be had, as it is the starch and glutin which gives binding power. Poor grades of flour are yellow, mealy and oily because they contain bran. They are high in fibre, fats and ash and create more gas. Tests have shown that a flour containing 50 per cent. less crude fibre, fat and mineral matter had 65 per cent. more strength than the inferior product, and 25 per cent. less flour was required to obtain equal strength which result would more than counteract the difference in cost. It has been found that some flours are adulterated with as much as 40 per cent. mineral matter. This should not be over 1 1-3 per cent. Fat, on the other hand should not exceed 2½ per cent., and fibre 1¼ per cent.

A simple test of further difference



SHRAPNEL SHELL FORGING WITH IMPROVISED PRESS EQUIPMENT.

The illustration shows a 750-ton press, normally used in a Canadian plant for boiler work, adapted to the production of shrapnel shell forgings from the billet. The short and long dies are for the first and second operations respectively. An output of 1,600 shell forgings per day was achieved. Special equipment has since been installed.

invisible to the naked eye, is to spread out on a piece of glass a small portion when the yellow color is easily seen. Another way of testing is to mix a little dough and try for toughness and dryness. A strong flour is shown by its readiness to absorb water, and make a clean dough that shows tenacity when pulled out. This result will be accentuated if the dough is left exposed for a short time before trying. If, in working, it is still sticky, the flour is not so good, but if it break short it is undoubtedly inferior.

Oil Binders.

Oil binders are made from linseed, fish, mineral oils and resin. Clay absorbs oil and therefore it is not beneficial to mix the two. Oils and gums flow through the sand and get in between the particles, while flour, resin and starch do not, but just bind adjacent grains. This segregation of binder causes an excess of gas at the point of segregation. Oil cores have very little green binding power though they are better than paste or dry binders. Oils containing mineral oil need longer to bake because the mineral adulterant must be volatilized before gums or pitches act.

Dry Compounds.

Dry compounds are made up of resin, pitch, dextrin, coke dust, and sometimes a little sawdust is added to facilitate removal from the casting. Dextrin is a green binder which is soluble in water and therefore flows to the contact points of grains of sand, when there is sufficient moisture added. Resin will not stand a high heat when baking as it melts at from 100 to 140 C. It is not soluble in water and has no green binding power. Pitch when in contact with molten iron forms coke which will not clean out.

Binders Soluble in Water.

Binders which are dissolved by water are molasses, sour beer, glue and the by product of the sulphite paper industry. The latter is very plentiful in Quebec Province, is strong, cheap, a good green binder, and can be used with clay wash or mixed efficiently with any other binder. It is composed of gums and resinous liquors which flow through the sand, giving contact at all points.

Testing Compounds.

In testing compounds, the relative cost per pound should be figured and a set of test cores made with constant quantities of new and old sand. The amount of compound should vary so that each set of cores costs the same amount. A convenient core box is a mold used for cement testing, and having enlarged ends for gripping in the test machine, while the area on which the load is applied is exactly one square inch. Some people prefer to use test cores 2 ins. square by 13 ins. long, and test transversely on 12 ins. centres. It is immaterial, however, what size bar is employed.

Core Tests.

Cores are examined for green binding power, change of shape, time of drying, appearance of exterior and interior, and strength. In recent tests, some cores even made of new molding sand having a degree of fineness of about 55. These were 300 per cent weaker than when made from the same old moulding sand having the same degree of fineness.

Another set of cores were made from new core sand with a degree of fineness of 35, and these cores were very much weaker than anything tested. The latter result was possibly due to the voids being too large in proportion to the quantity of compound used. The two tests confirm, however, that it is necessary to have a sand carefully selected as to size shape of grains and freedom from vegetable matter.

We found also that the by-product from the paper industry (sulphite process) could be used in the proportion of 55 sand to 1 binder with the same amount of clay wash as the latter; that it was 130 per cent. stronger than the cheapest oil tested; 150 per cent. stronger than the two dry black compounds tested, and about 140 per cent. stronger than flour. All were mixed with a constant quantity of the same sand, placed in the oven at the same time, and given the same degree of heat for the same period. The amount of binder, however, was varied in quantity according to the cost, so that all cores required the same amount of financial outlay. A number of the compounds tested contained the following substances:—

Black Compound.—Pitch, coal, resin, sawdust.

Oil Binder.—Dynamo oil, linseed oil.

Paper Industry By-product. — Gum resin, dextrin, pitch, sour beer.

Although the dollars and cents savings on the adopted practice over that recommended are not apparently very large, when taken in conjunction with the better casting features, there is to be noted a quite appreciable over-all benefit.

SHRAPNEL SHELL FORGING WITH IMPROVISED PRESS EQUIPMENT.

Start of second operation; two shell forgings being completed at one time.

Second operation completed; two finished shell forgings seen on either side of press dies.

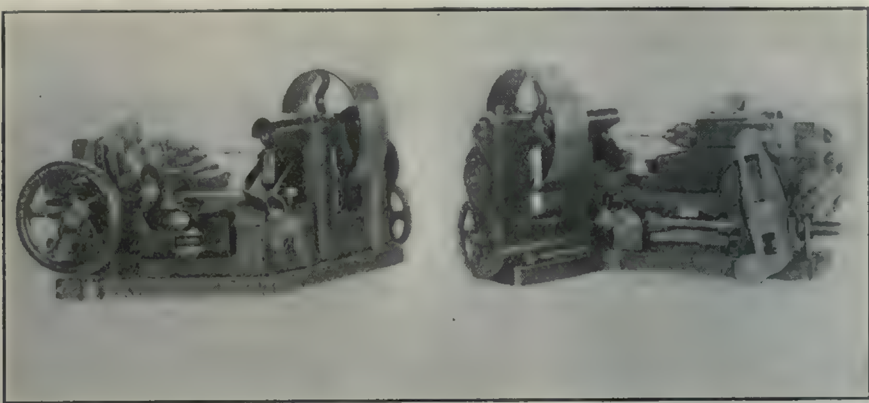
PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

AUTOMATIC DRILL FLUTING MACHINE.

FOR fluting twist drills, ¼ inch in diameter and smaller, the Bickford Machine Co., Greenfield, Mass., has developed a machine which in its design embodies several quite interesting features.

The machine is fully automatic for both forward and return movements of the carriage as well as indexing between the two flutes of the drill. The angle is constant between the cutter spindle and line of carriage travel, a special device providing increase of lead and thereby changing the angle of the cutting lip of the drill.



FIGS. 1 AND 2. AUTOMATIC DRILL FLUTING MACHINE.

Fig. 1 illustrates the method of driving the feed through spur, bevel and worm gearing from the cutter spindle to the cross shaft which carries a crank wheel and gives movement to the carriage through the L-shaped arm as shown. The peculiar shape of this arm is necessary in order to give a constant rate of feed when the crank wheel is making that part of its revolution while the drill is being cut.

A simple process of fluting the surfaces in contact prevents slipping where the link from the upper end of this arm attaches to the carriage, the same method being used to attach the crank pin, it being adjustable for different lengths of travel for the carriage. As shown, the carriage travels on a frame arranged to swing on the bushings which form the bearings for the crank wheel shaft, the front end of this frame carrying the bushing through which the drill is milled.

A lever underneath has one end arranged to swing on a stud provided with elevating screw and clamped to the frame of the machine, while the other end is carried downward by a cam on the crank wheel shaft during the forward movement of the carriage, this drop being greatly increased at the end of the travel of the carriage. A short link connects this lever with the swinging frame and thereby gives the increase of thickness to the web of the drill and also drops the drill free from the cutter for the return stroke.

Fig. 2 shows the method of obtaining the spiral, also the increase twist. The drill or work spindle is spur geared to a shaft carrying a bevel pinion in mesh with a bevel gear mounted on the side of the carriage. This bevel gear is revolved by a slotted arm which gets its motion as the carriage moves forward by contact with a small roller adjustably attached to the frame of the machine. The ratio of the gears is such that a movement of 45 deg. of the slotted arm will give 1¼ revolution of the drill spindle. This is a sufficient amount to give the spiral to the drill and is accomplished by setting the pin which carries the roller at such a height that the arm will make the necessary swing from its vertical position while the drill is being fluted. As the pin travels in a hosizontal direction relative to the centre of the bevel gear, the speed of revolution of this gear will be constantly decreased, thus giving the increase in length of the spiral to the flute of the drill.

The upper end of the swinging arm carries a short shaft on one end of which is a rectangular button, and on the other end a disc with four pins so arranged that, each time the carriage returns, this button is given a quarter turn by a latch in the top of the carriage and presents first a side and then an end to a block on the bevel gear. This gear is arranged to stop at a certain position as the carriage comes back and the button picks it up on its forward movement, the difference in position between the contact of the side or end of the button being equal to one-half a revolution of the drill spindle.

The cut shows the position of the carriage just as the button has made its quarter turn and is ready to pick up the block on the bevel gear with its end. The back-lash of the gearing is taken up during the return stroke by a pull spring and chain running over a grooved pulley. A 2 to 1 pair of gears throws out the feed worm on completion of the second flute of the drill. The hand wheel is attached for convenience in setting up the machine, as giving it a single turn performs the entire operation of making one flute.

A special form of guard and an oil spout allow the cutter to be flooded with oil or compound and carry all the chips to a strainer in the oil tank. The machines are designed to set in a row on a bench with a long trough to take the oil from each to a supply tank where the pump is located. Each is designed to use a high-speed cutter and has a productive capacity of 30 drills per hour of the ¼-inch size, change gears giving a range of five different feeds for smaller drills.

PORTABLE POWER PLANT.

EVERY machine shop, foundry, manufacturing plant and garage has at some time felt the need of a portable drill and grinder capable of doing really heavy work. The portable power plant shown in the illustrations combines all the advantages of a drill press and stationary grinder, and possesses, in addition, features that make it suitable for many applications where these tools could not otherwise be used. Fig. 3 shows the outfit being employed to remove the scale and corrosion from ammonia condensing pipes.

FIG. 2. PORTABLE POWER PLANT SHOWING FLEXIBLE SHAFT AND DRILLS.

The complete power plant consists of

a revolving tool bit socket mounted on the end of a flexible shaft which is driven by a Westinghouse Electric Co. motor through a variable speed friction disc device. The motor and friction drive are mounted on an iron base to which swivel casters are fitted, and the

FIG. 3. REMOVING SCALE FROM AMMONIA CONDENSING PIPES.

unit is enclosed in a metal case fitted with handles to facilitate carrying.

Adjustment is provided to take up wear on the driving disc, and to vary the contact between the discs for various classes of service. By means of a lever, speeds can be obtained at the tool, and the tool can be stopped without shutting off the current from the motor. By the use of attachments, eighteen speeds ranging from 165 to 3,200 r.p.m. can be secured for grinding, drilling and polishing.

The power plant is built in sizes from ¼ to 1 h.p., and the largest size will accommodate drills up to 1½ inches in diameter. Flexible shafts range in length from 5 to 10 feet. All sizes are driven by Westinghouse motors and are built for operation on any commercial circuit, either direct or alternating current, by the United Manufacturing Co., Kansas City, Mo.

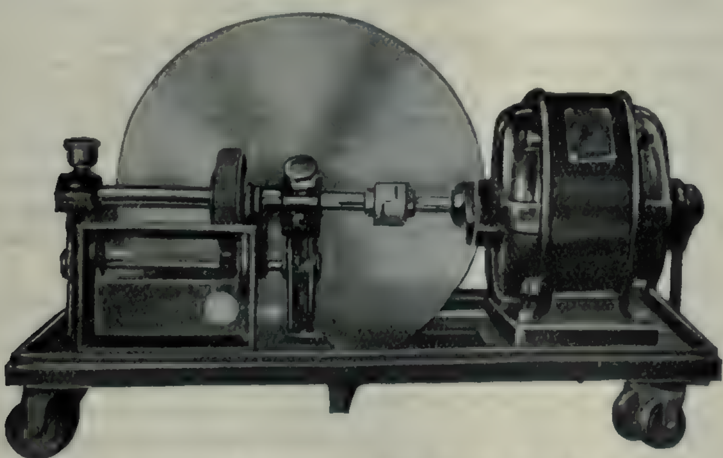


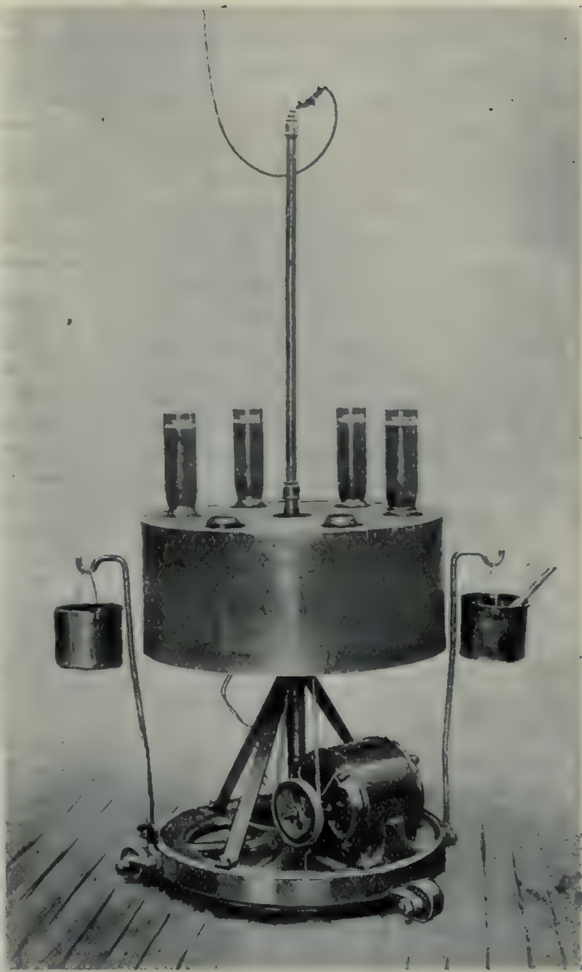
FIG. 1. PORTABLE POWER PLANT WITH COVER REMOVED.

SHRAPNEL SHELL PAINTING MACHINE.

THE machine here illustrated has been designed specially for the purpose of painting shrapnel shells, and is being made by the Canadian Fairbanks-Morse Co. at their Toronto plant. Although intended for 18-pounder shells, with modifications, shells of different calibre can also be painted. Easy operation is a prominent feature.

The shell is placed nose downwards into a socket, which revolves at about 250 revolutions per minute. No clamp or folding device is required, as the weight of the shell is sufficient to keep it in place. The sheet steel cover shown rests on the table, holding the sockets and protects the mechanism inside. The table containing the six sockets revolves on ball bearings at the will of the operator, and is independent of the mechanism rotating the sockets.

The belt from the motor is carried over two guide pulleys to a horizontal wheel running on ball bearings with a grooved periphery. Attached to this wheel is a sprocket wheel smaller in diameter, which is connected by a chain drive to a similar wheel of larger diameter secured to the spindle of one of the rotating sockets. On this spindle is another and smaller sprocket wheel, which is connected by an endless chain to a similar wheel on each of the other spindles. By this arrangement all the socket spindles revolve at the same speed independent of the movement of the table holding them. The standard is made of wrought iron pipe, secured to the base by stays and carries the table and operating mechanism. The pipe is wired for the motor, and can be connected to the lighting circuit.



SHRAPNEL SHELL PAINTING MACHINE.

The first paint coat is applied by means of a cloth, and to remove the shell, a pair of tongs are used which grip on the copper band. The second coat is applied with a brush, as is also the third coat. While the second coat is being applied, a sheet iron stop fastened to the cover is moved into position against the shell to act as a gauge when painting the nose red to the proper width. Stands for paint cans are attached, and two men can work at one time. The machine is portable, and so can be taken to the work without any difficulty. It is claimed that three coats of paint per shell can be applied in less than one minute.

SHELL MAKING IN GREAT BRITAIN.

THE tonnage and variety of shells now being turned out in the Sheffield district is, of course, stupendous, says "The Engineer," but that information is the sort of thing about which the less said the better in these days. The important point is that they are being made, and at a rate which had hitherto seemed impossible.

At the annual meeting of Hadfield's, Ltd., a few weeks ago, however, an interesting light was thrown upon the operations. A. M. Jack, one of the directors, referring to a 4.5 in. howitzer shell exhibited in the room, explained that it had been turned out at an entirely new installation which had been erected at Hadfield's works in what, in the middle of November, was a field. They had had to design the works, get them erected, order 300 or 400 lathes and other tools and train the necessary men. All that had been done in four or five months, and they were now putting down other plant of equal or greater magnitude.

Sir Robert Hadfield hamself had some equally interesting things to say. They had, he said, introduced several steel developments, including a "sound steel" invention, which reduced waste from 40 to 15 per cent., and the free use of this discovery was offered to any firm during the war for increasing the output of high explosive shell.

Referring to the Government's present efforts to maintain and increase the equipment of the growing army, Sir Robert complained bitterly, that, through the dilatoriness of a former War Minister, the Army had been found unready at a moment of national emergency. As an instance, he said, "We had equipped ourselves with a splendid plant for producing shrapnel on a very large scale. After the Boer War our orders came to an end. We went to the War-office and told them it was a pity to see a fine plant like ours with nothing to do. They shrugged their shoulders and said 'Very sorry.'

"We went a year later, this time taking a photograph of the plant showing that it had been necessary to utilize the building, which was piled up with patterns and models, these being placed on the top of the valuable machinery. Still the same reply, 'We have nothing for you.' It was disbanded, and the use of a plant capable of producing immense numbers of shrapnel or other shell was entirely lost to the nation. In August last, when the war broke out, if we had then had this plant in working order it would have been worth $500,000 to the Empire."

It may be recalled that the big extensions which have been going on at Hadfield's have their counterpart at Vickers', Browns', Cammells', Jessops', Edgar Allens' and many others of the large British steel works. The increase in output since August is astounding.

ANOTHER LARGE TELESCOPE ORDERED.

CLEVELAND, Ohio, has again asserted its right to first place among American cities in point of astronomical instrument manufacture with the recent announcement that the Warner & Swasey Co., 5701 Carnegie avenue S. E., has been awarded the contract for the construction of a sixty-inch reflecting telescope for the national observatory of Argentina at Cordoba, Argentine Republic.

This is the second large contract to be handled by the Warner & Swasey Co. within the year. A few months ago the company began the construction of the largest reflecting telescope in the world for use by the Canadian government.

While this new telescope will not rival in size the instrument now under way for Canada, it will rank high among the greatest telescopes in the world and will be the largest in use in the southern hemisphere.

The mirror for the new engine of science is a disc of glass sixty-one inches in diameter, eight inches thick and weighs one ton. The disc of glass from which the reflecting mirror will be made was cast in France, but the figuring of the curves and the delicate and difficult operation of grinding the glass to the proper form and polishing it, prior to the operation of silvering, will be performed under the direction of Prof. Charles D. Perrine, director of the Argentina observatory.

The great tube, twenty-seven feet long and six feet in diameter, with its accessories, will weigh more than fourteen tons. It will be so constructed and so moved by electric motors as to follow the star under observation without deviating the width of a spider thread.

COMING CONVENTIONS.

National Metal Trades' Association, Hotel Astor, New York.—April 12-15.

Southern Supply and Machinery Dealers' Association, Atlanta, Ga.—April 14-16.

National Association of Manufacturers, Waldorf-Astoria, New York.—May 18-19.

National Machine Tool Builders' Association, Atlantic City, N.J.—May 20-21.

Master Boiler Makers' Association, Chicago, Ill.—May 26-28.

American Iron, Steel and Heavy Hardware Association, St. Francis Hotel, San Francisco, Cal.—May 25-28.

American Supply and Machinery Manufacturers' Association and National Supply and Machinery Dealers' Association, Hotel Bellevue-Stratford, Philadelphia, Pa. (Joint convention.)—June 3-5.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Railway Supply Manufacturers' Association. Convention and exhibit in conjunction with the Railway Master Mechanics and the Master Car Builders.—June 9-16.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

A RAPID ENAMELING PROCESS.

AN enameling process, the distinctive feature of which is a quick-drying secured by heating the objects treated in large ovens under a relative high percentage of humidity, has been perfected by the Fickling Enameling Corporation, Long Island City, New York. By this method, known as the Radio-enameling process, an automobile can be refinished in three days.

After the initial enamel has been applied by either dipping or spraying, the parts are placed in these specially constructed ovens and dried under a uniform temperature and humidity. Thermostatic control keeps the temperature between 110 and 120 degrees F., and water control on a diaphragm regulates the humidity at a point about 40 per cent. of saturation. Where the character of materials allows, the temperature is increased to as much as 200 deg. The final enamel is subjected to a similar baking at a slightly lower temperature.

Drying in the ovens under the constant relation of temperature and moisture, and the use of water-washed air are said to secure more lasting enamel than is possible by ordinary air drying. Keeping the outer surface green permits the inner layers to dry and set, thus securing a hard and enduring foundation. When dried in the open air the surface becomes hard, while the under coatings may be green for some time. On automobile hoods this results in sweating. W. I. Fickling, president of the corporation, is of the opinion that the radio method will have wide industrial uses because of the time saved in drying. One oven 19 ft. x 6 in. x 42 ft. is in use at present and Mr. Fickling holds that the method would be efficient with even a larger oven.

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Vol. XIII. APRIL 15, 1915 No. 15

PRINCIPAL CONTENTS.

SHOP STANDARDS AND NATIONAL STANDARDS.

RECENTLY we have received a number of inquiries with regard to Canadian standards of mechanical measurement such as relate to screws, wire gauges, etc. To the great majority of these answer is made that we have no standards as a nation, and that the system of measurement to be employed is left almost entirely in the hands of the individual manufacturer. In the choice of gauges these latter are too often governed by strictly first cost considerations and not by ultimate national economy. A large number of manufacturers, however, are seeking for standards and would gladly adopt national standards if they existed. Under the circumstances, many of our more prominent machine builders have adopted the standards of either the United States or Great Britain.

There is no good reason why the better standards of other countries should not be legally adopted by Canada. These, in most instances, have been prepared at great expense, and have been the result of much laborious work. Besides, they could be appropriated by a new country without sacrifice of national dignity. The work of a body appointed for this particular purpose would then, not be the formulating of standards but the choice of the most suitable, and the fewest possible consistent with completeness.

CHARLES M. SCHWAB AN INSPIRATION.

THE annual report of the Bethlehem Steel Co. shows net profits for 1914 of $9,378,385, equal to 31 per cent. on the common stock, yet Charles M. Schwab, the president, who practically controls the concern, always has refused, and still refuses, to pay any dividend on these shares. Instead, he proposes retaining the money and putting the business on a thoroughly substantial basis, so that when dividends are begun they are likely to be maintained.

This is without question a sane policy. Experience of the past twelve months shows that a number of concerns in Canada should never have paid dividends. On the other hand, several Canadian companies have without good reason suspended dividends since the outbreak of the war, and thus unjustly treated their shareholders.

Mr. Schwab was the real founder of the combination known as the United States Steel Corporation and was its first president. Differing from his co-directors on matters of policy, he resigned and undertook the reorganization of the United States Shipbuilding Co. Out of this he evolved the Bethlehem Steel Co., which has been brilliantly successful. At 40 years of age, he had one of the most magnificent residences in New York and more millions than he could ever use, but he abandoned this luxurious and comfortable life, and made his home at the main plant in Bethlehem, Pa., worked day and night in the shops; organized and reorganized, until he brought the quality of his product to the highest perfection. He then went out and sold it himself—that is, he made the important sales.

In this respect he combined two qualities that seldom are found together. He is not only a great steel maker, but he is an unusually successful salesman. At one time he is showing his foreman how to improve the quality or the capacity of a department; a few weeks later he may be in St. Petersburg selling battleships, submarines and war material to the Czar and Government of Russia.

There are many shareholders in Canadian corporations who would like to see more of this combination in their presidents and general managers, and this story of Mr. Schwab is published for their inspiration. The selling of a product is generally much harder than its manufacture, and most managers unfortunately prefer the easier life and stay in the plants.

Mr. Schwab is regarded as the greatest steel maker in the world, but we are inclined to the opinion that it is as a salesman that he has done his most brilliant work.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 9 50	$10 00
Copper, crucible	11 00	11 50
Copper, unch-bled, heavy	11 00	11 50
Copper, wire, unch-bled.	11 00	11 50
No. 1 machine compos'n	9 50	10 00
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 00	9 50
No. 1 brass turnings	7 00	7 25
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal
Standard				
¼, ⅜ in.	64	47	....	....
½ in.	69	56	....	....
¾ to 1½ in.	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in.	74	61	73	60
4½, 5, 6 in.	....	....	72	59
7, 8, 10 in.	....	....	68	56
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	41	....	....
½ in.	63	50	....	....
¾ to 1½ in.	68	55	....	....
2 in.	68	55	64	51
2 , 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in.	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload	$17 25	$17 25
Electrolytic copper	17 00	17 00
Castings copper	16 50	16 50
Tin	54 00	56 00
Spelter	12 00	12 00
Lead	5 65	5 75
Antimony	23 00	25 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh.	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.71
Linseed oil, raw, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$8.00
5/16 inch	5.35
⅜ inch	4.60
7/16 inch	4.30
½ inch	4.05
9/16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. galvanized)	4 50	4 50
Queen's Head, 28 B.W.G.	4 60	4 60
Fleur-de-Lis, 28 B.W.G.	4 30	4 30
Gorbal's Best, No. 28	4 60	4 60
Viking metal, No. 28	4 20	4 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 20	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., April 12, 1915.—Trade conditions generally have been rather quiet during the week. However, as the opening of navigation approaches, there are being made manifest a number of activities which lead one to believe that conditions will improve shortly. Of course, the improved transportation facilities will also lend an impetus to the export and import trade. Much speculation is at present rife as to just how much actual benefit trade will receive from navigation this year, on account of the shortage of tonnage. The latter conditions will be somewhat relieved, it is understood, by the bringing down from the Lakes of a large number of boats. A considerable contraction in the freight traffic on the Lakes is anticipated and thus the vessels remaining will be able to handle the amount comfortably.

It is not anticipated that there will be as great a volume of steel merchant bars imported from British mills as formerly. All the steel produced in Britain will likely be required for war and domestic purposes. Enquiries for steel products are, however, becoming more numerous and a better tone is developing. Foundries are not doing much, and very little pig is likely to be imported this season. Machine tools present a rather peculiar

situation at present. Certain lines are in great demand, while other lines are practically dead. The metal situation presents a very quiet appearance.

The Steel Trade.

In structural sections, very little steel is moving, as throughout the province but little building is being done. Merchant bars are, however, in fair demand. Many companies engaged largely in the manufacture of shrapnel shells are also making the rough shell forgings. The shell being manufactured more largely than any other in Canada at present is the British 18-pounder. Round steel bars 3½ inches in diameter are used for this work and a considerable tonnage of this size bar is required weekly. In other lines of merchant bars, little business is moving.

In view of the large order received by the Canadian Car & Foundry Co. for shrapnel shells from the Russian Government, it is reported that this firm are moving their forging plant from Fort William to their local shops. A great part of this contract is being placed in Canada, Western shops participating to a considerable extent.

Tool steel manufacturers are receiving many orders because of the shell business, high-speed steel being used practically to the exclusion of the poorer qualities. Besides, the jigs and fixtures employed in the manufacture of shells require that a high-speed steel and one that holds its cutting edge well under severe usage, be used, otherwise the advantage gained by expensive tooling would be to a great extent lost.

Pig Iron.

Throughout the country foundries are operating at only a fraction of their capacity and thus little iron is being purchased. It is not likely that Britain will export much pig iron during the war, as it may be required for use at home. Prices are not changed.

Machine Tools and Supplies.

The demand for machine tools which can be used in the manufacture of shells continues, as more shops are engaging in the work. It is now rumored that orders for larger shells than the 15 and 18-pounders, of the high explosive type, are about to be placed. Old machines are being rebuilt and refitted, standard machines are being tooled up, and machinery manufacturers and dealers are also doing their utmost to supply the demand. Shop supplies are, as a result, showing marked activity.

Metals.

Generally speaking, the metal situation can be summed up as being very quiet. Copper has advanced in New York, and in Canada the prices have risen in sympathy. Tin has been very dull of late, and spelter has not changed much in price. Lead is up slightly owing to a similar advance in the United States prices. Antimony continues to be a very scarce article, but no change in price is reported this week. Aluminum is quiet.

Toronto, Ont., April 13, 1915.—There has been no change to speak of since last week in industrial conditions, although the outlook is improving. There is a somewhat better tone in business circles although it is doubtful if there will be much improvement in trade generally until the end of the war. The financial stringency will be felt while the war lasts and meantime all business operations are being conducted on a conservative basis. It also follows that industrial development will be restricted during this period.

The shell industry is developing and some concerns are doing well. If it were not for this business many engineering works would be practically closed down. The steel trade, apart from the demand for shells, is showing a little improvement and the outlook is brighter. The building trade is quiet and there are few enquiries for structural shapes. The situation in machine tool circles both in the United States and Canada is unprecedented, the demand for tools for machining shells being so heavy that the manufacturers in the States are sold out months ahead. Russia, France, England and American firms are all buying tools for making shells.

Steel Market.

There is little change in the situation in the steel trade except as regards the demand for steel for shells which is increasing. The mills making forgings for shrapnel shells are working to capacity to meet the demand, which is so great that some firms are having to wait for forgings. Those concerns, however, which have forging plants are not affected. Considerable business is being done in round bars for the high explosive shells. It is reported that the Lackawanna Steel Co. has booked an order from Canada for 20,000 tons of 3½ in. x 5 in. rounds. Prices are firmer but unchanged.

Production in the steel trade in the States is increasing principally on account of the demand for steel products from the Allies. Large orders for shrapnel shells and rounds for shells have also been booked for shipment to Europe. Quotations on bars and beams have advanced to $1.20 f.o.b. Pittsburgh.

Pig Iron.

There is no change in the pig iron situation and the market is quiet. The demand is not sufficient to really test prices.

Machine Tools.

The difficulty of obtaining anything like satisfactory delivery on tools for making shells has caused more or less of a lull in the trade. Those firms who have recently come into the market for tools will have in some cases to wait two or three months for delivery. The reason of this is, of course, the heavy demand from Europe and the large number of tools required by U. S. firms for making shells. Every suitable machine available, new or second-hand, is being bought up. Ordinary business is picking up, but is still considerably under normal.

Supplies.

The demand for machine shop supplies is improving and dealers report satisfactory business. Dry red lead has advanced and is now quoted at $7.62 per cwt. Turpentine is 2c higher, being quoted at 71c a gallon. Prices generally are firm.

Scrap Metals.

The market is quiet, but the outlook is better. Prices are firmer but unchanged.

Metals.

There is an improved tone in the metal markets, but business is light in volume and consumers are conservative in their buying. The primary markets generally have a quiet tendency with the exception of copper which is strong at advanced quotations. The tin market is unsettled for spot metal, owing to the embargo.

Copper.—The demand for copper for munitions of war is heavy and consequently the market is strong. The market has advanced ½c and lake copper is quoted locally at 17¼c per pound.

Tin.—The limitations recently placed on the export of tin by the British Government has created some excitement in the New York market, on account of the delay in obtaining spot metal which is being quoted at 53c in that market. London market has also advanced, supplies being scarce. In the local market quotations are nominal at 56c representing an advance of 2c per pound.

Spelter.—The heavy demand from Europe continues but the situation is unchanged. Quotations are unchanged and nominal at 12c.

Lead.—The lead market is firm but quiet. Prices are unchanged at 5¾c per pound.

Antimony.—The market is quiet and unchanged. English brands of antimony are practically unobtainable. Quotations are unchanged and nominal at 25c per pound.

Aluminum.—The market is steady and quotations are unchanged at 23½c per pound.

IMPROVEMENT IN CANADA'S REVENUE.

MARKED improvement is shown in official figures of the Dominion revenue for the three months of the present calendar year. Receipts, since the introduction of the budget, have more than equalled the revenue for the corresponding ante bellum months of last year.

The improvement is shown in the following comparative statement for the months since the outbreak of the war and those of the previous year.

Total Revenue.

	1913.	1914.	Decrease.
August	$14,547,853	$14,946,104	$ 351,748
September ...	15,249,258	9,953,093	5,296,165
October	14,225,598	10,641,254	3,584,343
November ...	13,536,981	9,495,536	4,041,445
December	12,931,466	9,167,940	3,763,526
	1914.	1915.	
January	$11,529,753	$ 9,897,664	$1,632,089
February	9,698,120	10,523,344	*825,223
March	11,686,901	11,641,970	46,931

*Increase.

The special war tax becomes operative on the 15th of this month. It would appear that the measures taken by the Government to cope with the financial situation created by the war are likely to prove successful.

CEDARS RAPIDS MFG. & POWER CO.

A NEW contract calling for the delivery of 5,000 h.p. has been closed by the Cedars Rapids Mfg. and Power Co. It has been agreed to deliver over the transmission lines of the Aluminum Co. of America, the above quantity of power to the Northern Power Co., which is located at Messina Springs, New York State. The power will be distributed by the American company to small consumers located within a radius of fifty miles from Messina Springs. Howard Murray, vice-president of the Cedars Rapids Co., states that the new contract has been signed, but that at present it was impossible for the management to express an opinion as to when deliveries would be commenced.

At the present time the Aluminum Co. of America are taking 40,000 of the 60,000 h.p. contracted for, and will gradually increase this amount as new machines at the works are installed. It is expected that before the summer they will be taking the whole of the 60,000 h.p. unless some unforeseen construction difficulties occur. The Montreal Light, Heat and Power Co. are taking all of the 20,000 h.p. called for in their contract with the Cedars Rapids Co.

The new contract with the Northern Power Co. is a very favorable one, inasmuch as it does not call for any expenditure on the part of the Cedars Rapids Mfg. and Power Co., but simply means adding 5,000 h.p. to the quantity already being supplied to the Aluminum Co.

Col. A. Bertram, chairman of the Dominion Shell Committee, has been promoted to the rank of Brigadier-General, attached to the General Staff.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Canadian.

British West Indies.

E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Phillipe Roy, Commissioner General 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.

Harrison Watson, 72 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hnos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiania, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Orillia, Ont.—The Fisher Motor Co. has started work on a contract for shrapnel shells.

Seaforth, Ont.—The Bell Engine Works will install machinery to manufacture shrapnel shells.

Newmarket, Ont.—The town council has decided to buy a 16 h.p. electric pump for use at the waterworks station.

Thorold, Ont.—Fire which broke out on April 6 completely destroyed the large moulding shop of the Thorold Foundry Co.

St. Mary's Ont.—A by-law will be prepared in connection with the installation of a new street lighting system and gasoline engine.

Montreal, Que.—The Drednot Motor Truck Co. have secured a factory at Wellington and Nazareth streets and will install additional machinery.

London, Ont.—P. A. Seeker of Marine City, Mich., has purchased three acres of land just east of here for the erection of a $65,000 automobile factory. Some 50 hands will be employed on the start.

Hespeler, Ont.—A. B. Jardine & Co. has just made a large shipment of portable field forges to the military department at Ottawa, and are completing a carload of general blacksmith tools, which they will ship to the West in the course of a few days. The firm expects to be ready to start the manufacture of shells inside of two weeks, and they will then run their factory night and day.

Municipal

Welland, Ont.—The town council is considering the question of installing an incinerator.

Toronto, Ont.—Tenders are being called for an incinerator to be installed on the Island.

Toronto, Ont.—Fire at the John Taylor Soap Works, Front Street, on April 11, did $13,000 damage.

Toronto, Ont.—It is reported that the T. Eaton Company may build a factory at Mount Dennis, near here.

Preston, Ont.—A by-law will be voted on by the rate-payers on April 26, to raise $25,000 for the Preston Mills Co., who will manufacture handles and wood products.

Saskatoon, Sask. — The Board of Trade announces that a fibre company from the United States is about to build a flax mill there.

Lindsay, Ont.—A New York concern are negotiating with the Town Council regarding a suitable plant for manufacturing explosives.

Toronto, Ont.—The Board of Control recommends that the contract for an incinerator to cost $49,000 be awarded to the Canadian Griscom-Russell Co., of Montreal.

Swift Current, Sask.—A by-law to raise $75,000 for the completion of the electric light and power plant, and another to raise $25,000 for the purchase of a city hall site, have been introduced in council.

Vancouver, B.C.—A resolution passed by the West Kitsilano Ratepayers' Association, urging that the city take steps to install its own electric lighting plant, has been adopted by the Central Ratepayers' Association.

Electrical

Blenheim, Ont.—A hydro-electric system will probably be installed here. The cost is estimated at $14,000.

Beamsville, Ont. — The Dominion Power & Transmission Co. will inaugurate a meter system here and henceforth all lighting and power contracts will be made on meter basis.

Kincardine, Ont.—The water and electric light commission will purchase a number of brackets for electric lamps. Incandescent lamps will be used instead of the present arc lamps.

Kamloops, B. C.—Hydro-electric bylaws aggregating the sum of $85,000 were voted upon on April 6th, passing with a large majority. This money will be used for completing the hydro-electric system upon which half a million dollars has been expended. The city anticipates great results through their fine power plant, which it is expected will be in operation in course of a few weeks.

Railways—Bridges

London, Ont.—The official opening of the London & Port Stanley Railway, which will make the first hydro-radial in operation in Ontario, is to be held on July 12. The road will be formally opened by Sir Adam Beck.

Ottawa, Ont.—At a meeting of the Railway Commission held here on April 6, Assistant General Manager Alfred Price, of the C. P. R., stated that all locomotives would be fitted with a new type of dump ash pan.

Saskatoon, Sask.—The Commissioners are recommending to the city council that a new diamond crossing be installed on Twentieth street. The total cost of installing the new diamond, including labor, is estimated at $1,436.25.

Brantford, Ont.—It was stated by an official of the C. P. R. that, though no official decision has yet been given, the Lake Erie & Northern Railway from Port Dover to Galt, through Brantford, will be electrified, to run in conjunction with the Galt, Preston & Hespeler Railway, owned by the C. P. R.

Brantford, Ont.—The first report of the Brantford Municipal Railway Commissioners shows that total receipts were $33,411.91 for the period August 4 to December 31, and after paying expenses of $25,506.85, there was a balance of $7,905.05 to pay interest on purchase price and bonded debt. Passengers carried on the street railway totalled 300,250; car mileage was 88,892, and total receipts amounted to $13,145.97. The Grand Valley Railway carried 93,231 passengers on 68,294 mileage, with receipts of $18,551.45.

General Industrial

Riverton, Man.—A pulp mill may be established here by an Eastern syndicate.

Toronto, Ont.—J. A. Livingstone of Renfrew has purchased a plant here and will make concrete blocks and similar products.

Sherbrooke, Que.—The Board of Trade is negotiating with a firm in New York who may locate a plant here. J. S. Mitchell & Co., of Sherbrooke, are interested.

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Toronto, Ont. — The David Smith Lithographing Co. has bought a factory building at the corner of Strickland and Noble Streets.

Blenheim, Ont.—A syndicate has been formed with a capital of $10,000 to establish a tobacco factory. E. G. Thompson and T. B. Shillington are interested.

New Westminster, B.C.—The Brackman-Ker Milling Co., are making arrangements for an early start on the construction of the new elevator. Gardiner & Mercer are the architects.

Hamilton, Ont.—The interior of the Parker Dye Works, East King street, was entirely demolished on April 1, when one of the gasoline tanks exploded. The damage is estimated at $10,000.

Lindsay, Ont.—Horn Bros.' industrial proposition was discussed at a meeting held on April 8. The company propose to erect a $55,000 factory and install $75,000 worth of machinery. It is proposed to commence building on Oct. 1.

Goderich, Ont.—J. Ransford, of the Goderich Salt Co., proposes to install a modern salt plant here and increase the output to over double the present capacity. He asks free water and light, 10 horse-power from the hydro-electric and exemption of taxes for ten years.

Brantford, Ont.—The Canadian Westrumite Co., recently reorganized, which took over the plant of Westrumite, Ltd., will shortly commence operation at the local plant, which will be considerably enlarged and improved. W. D. Preston, of New York, has been appointed manager.

Trade Gossip

The Napanee Iron Works, Ltd., Napanee, Ont., have appointed F. H. Hopkins & Co., Montreal, sole sales agents for Canada for their "Napanee" hoisting engines.

A. H. Winter-Joyner, Ltd., Toronto, who handle street lighting equipment, electrical indicating and recording instruments, etc., have removed from 76 Bay street to 100 Wellington street, west.

Fraser & Chalmers of Canada, Ltd., announce that on May 1, on account of the necessity for increased space, brought about by their rapidly-growing business, their head office will be transferred to 59 Beaver Hall Hill, Montreal.

A new charter has been granted to William R. Perrin, Ltd., to continue the manufacture of hydraulic power screw and filter presses and abattoir machinery, formerly carried on by W. R. Perrin Co.

Tractors to Haul Guns.—The Russian Government have purchased the entire stock of 70 horse-power gasoline tractors belonging to Marshall, Sons & Co. (Canada), Ltd., and which are at present in warehouse on the Industrial site at Saskatoon, Sask. Shipment will be made via Vancouver and Vladivostock.

Brantford, Ont.—John A. Sanderson, president of the Adams Wagon Works, has returned to the city after a two months' business trip in the Old Country. Mr. Sanderson was accompanied by Gordon Cockshutt, who travelled in the interests of the Slingsby Manufacturing Co. Substantial war orders were secured by them.

Canada's First Shrapnel Shell.—Hon. Sam Hughes, Minister of Militia, was presented last week by the Nova Scotia Steel & Coal Co. with the first 18-pounder shell forged and finished in a Canadian workship. It was mounted on a mahogany stand. The shell was made from Nova Scotia open-hearth steel, and was presented by the Hon. Col. Thos. Cantley.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British.—Lieut. Johnston and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Shell Manufacture at St. John, N.B.—The Commissioner of Public Safety, St. John, N.B., has recommended that the machinery hall on the exhibition grounds be rented to T. McAvity & Sons, for the term of one year or portion thereof, as may be necessary, for the purpose of manufacturing shells, such tenancy to be terminated at any time by one month's notice on either side. Rental to be at the rate of $500 per annum, payable monthly. Messrs. McAvity are to make all necessary repairs to the boiler and engine at own cost and to pay such extra insurance premium as may be required.

Dominion Steel Output.—The output of the Dominion Steel Corporation has been going largely to Great Britain recently, and there the company has meantime a satisfactory outlet for its product if shipping facilities can be assured. A fair improvement in pig iron, wire rods, bars, and wire products is shown in the output for March. The production in tons, is reported as follows:

	1915.	1914.
Pig iron	23,669	22,619
Steel Ingots	25,807	28,352
Rails	6,102	18,359
Wire rods	4,543	2,981
Bars	316	....
Wire and wire products	3,359	2,246
Shipments	20,086	16,813

The coal output was 364,542 tons in 1915, compared with 391,887 tons last year.

Personal

Captain Malcolm McLeod, former harbormaster of Vancouver, B.C., is dead at the advanced age of 80.

Paul Mercier is acting city engineer at Montreal during the time that city engineer Major George Janin is on active service with the corps of Canadian engineers.

Capt. B. J. McCormick, late Industrial Commissioner for Welland, Ont., has left for Hamilton in charge of the third overseas contingent of the 44th Regiment.

Sam Buchanan, who for the past twelve years has been superintendent of the Upper Lake Division of the C. P. R. steamship service, will retire from active service on May 1st.

Arthur H. McGuire, of St. John, N.B., has been appointed sales manager for the Canada Cement Co., with headquarters in Calgary, Alta. He has been with the company on its travelling staff for some years, and is one of its most valued employees.

H. B. Smith, of Owen Sound, was re-elected president of the Northern Navigation Co., at the annual meeting of the company held at Montreal on April 1 last. Mr. Smith was also re-elected as a director of the Canada Steamship Lines, ltd., of which the Northern Navigation Co. is a subsidiary company.

John Cowan, president of the Ontario Malleable Iron Co., Oshawa, Ont., died at his home in Oshawa on April 8, aged 86. Mr. Cowan was born in Tyrone, Ireland, and came to Canada in 1841. He settled in Toronto. In 1866 he went to Oshawa to manage the Cedarvale Ironworks, and five years later or-

ganized the Ontario Malleable Iron Co., of which he was president till the time of his death, a period of 43 years.

W. H. Snell, general agent, passenger department, of the C. P. R., at New York, has been appointed to succeed the late William Stitt as general passenger agent, eastern lines, at Montreal. Mr. Snell, who is a native of Montreal, joined the C.P.R. as clerk to the treasurer, in 1890. In 1902 he became chief clerk to the district passenger agent at Boston, and two years later was appointed travelling passenger agent of the same office. In 1910 Mr. Snell became Eastern passenger agent at New York, and last year was promoted to general agent, passenger department, at New York.

Tenders

Toronto, Ont.—Tenders will be received by the Board of Control up to Tuesday, April 27th, 1915, for the supply and installation of one sludge pump for the main sewage disposal works, Toronto. Specifications and forms of tender may be obtained at the Works Department, City Hall.

St. Catharines, Ont.—Tenders will be received by the Architect until Monday, May 3, 1915, for all trades required for the erection and completion of a new Collegiate Institute to be erected in St. Catharines, Ont. A complete set of plans and specifications may be seen at any reasonable time at the office of the architect, A. E. Nicholson, 46 Queen street, St. Catharines, Ont.

New Incorporations

The Rideau Power Co. has been incorporated at Toronto with a capital of $80,000 to develop water power at Merrickville. Incorporators: Thomas Grattan Kyle, Robert W. Watchorn, all of Merrickville, Ont.

Simplex Asphalt Paving Co. has been incorporated at Ottawa with a capital of $100,000 to carry on a business as contractors at Montreal, Que. Incorporators: Frederick H. Markey and Waldo Whittier Skinner, all of Montreal, Que.

Canada Steam Furnaces, Ltd., has been incorporated at Toronto with a capital of $150,000 to manufacture and sell steam and all kinds of furnaces at Toronto. Incorporators: Joseph Denis, W. D. Wilson, of Toronto, Ont.

The Premier Electric Co. has been incorporated at Ottawa with a capital of $49,000 to carry on business as electrical contractors at Montreal, Que. Incorporators: Louis A. David, Louis E. A. D'Argy Mailhiot, all of Montreal.

Meriden Britannia Co. has been incorporated at Ottawa with a capital of $400,000 to manufacture silverware and electro-plated goods at Hamilton, Ont. Incorporators: George Horace Wilcox and George Munson Curtis, of Meriden, Conn.

MacIntyre, Haining, Kelly Construction, Ltd., has been incorporated at Toronto with a capital of $40,000 to carry on the business of a construction company at the city of Sault Ste. Marie, Ont. Incorporators: Alexander MacIntyre, of Steelton, Ont., and John Nornal Haining, of Sault Ste. Marie, Ont.

Reliance Knitting Co. has been incorporated at Toronto with a capital of $200,000 to manufacture and deal in textile fabrics including knitted goods and woven goods at Toronto. Incorporators: Ferguson James Dunbar, B. Taylor, of Toronto, Ont.

The Pacific Great Eastern Equipment Co. has been incorporated at Ottawa with a capital of $3,000,000 to manufacture railway cars, wagons, etc., at the city of Vancouver, B.C. Incorporators: Patrick Welch, Edward F. White, all of Vancouver, B. C.

George McKnight & Co. has been incorporated at Ottawa with a capital of $40,000 to carry on business as a general engineering and construction company at Montreal, Que. Incorporators: Louis Athanase David and Segfried Hinson Read Bush, all of Montreal.

Shawinigan Electro-Metals Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture all kinds of metals, minerals, etc., at Montreal, Que. Incorporators: Howard Murray, Theophilus Hatton Wardleworth, all of Montreal, Que.

Wood-Working

Port Dover, Ont.—The Port Dover Planing Mills Co. will install machinery for the manufacture of chairs and furniture frames.

Saskatoon, Sask.—The Rat Portage Lumber Co., Winnipeg, has sold its local sash and door branch to Cushing Bros., who will operate it in connection with its factory.

Collingwood, Ont.—The planing mills and woodworking factory of the Bryan Mfg. Co. were destroyed by fire on April 11. The loss is estimated at $70,000, in which there is 80 per cent. insurance.

Kincardine, Ont.—There is probability of an addition being built to the Coomb Co. furniture works, as there is not sufficient storage accommodation to supply the wants of the trade.

Marine

Ottawa, Ont.—The sum of $30,000 has been appropriated for the purchase of a new vessel for protecting fisheries on Lake Erie.

Kingston, Ont.—The Davis Dry Dock Co. have started to build a pessenger steamer for the Seven Rivers and Lake Couchiching Navigation Co. The craft will be 70 ft. long, 12 ft. beam and 5 ft. deep, and will be built of white oak.

Montreal, Que.—Specifications are now being prepared and tenders will shortly be called for the construction of a new ferry boat for the St. Helen's Island service. The city proposes to operate the ferry service.

Quebec, Que.—Two lighthouses are ready for service in the river below Quebec. The C.G.S. Druid has left to set the lights at Crane Island and the Beaujeu Banks. The Government ice-breakers Lady Grey and Montcalm have reached Nicolet, and are expected to reach Sorel in the first days of April.

Montreal, Que.—The passenger and general cargo service of the Black Diamond Steamship Line, which the Dominion Coal Co. has operated for many years between the ports of Montreal, Prince Edward Island, Sydney and St. John's, Nfld., will be discontinued, according to a statement made recently at the head offices of the company in this city.

Sault Ste. Marie, Ont.—Supt. Davis, of the Michigan Northern Power Co., has announced that work on the regulating and compensation structure above the rapids in St. Mary's river would be started April 1. The Great Lakes Dredge and Dock Co. will lay a sub-structure for the dam. These works will be used in regulating the flow of water across St. Mary's Falls, the outlet of Lake Superior, and will keep water level in lakes at an even station. The contracts approximate $250,000.

Building Notes

Midland, Ont.—W. H. Switzer, of Orillia, has been awarded a contract for a school building to cost $29,000.

Victoria, B.C.—A building permit has been issued to T. R. Cusack for a warehouse to cost $5,000. Luney Bros. are the contractors.

Artificial Lighting in Relation to Manufacturing*

By G. H. Stickney **

Not one of the least prominent features of the "Safety First" movement is that relating to the improvement of the natural and artificial lighting of our workshops and factories. In the accompanying article, the more important considerations to be accounted in the matter of artificial illumination are exhaustively discussed from a variety viewpoint.

WHILE a very conspicuous advance in lighting methods has been made by progressive manufacturers, notably in the iron and steel industry, there are still a large number of manufacturers who seem to regard the lighting as an expense to be reduced to the lowest possible minimum.

The increased appreciation of daylight is indicated by the modern type of building construction, in which the light-finished, high studded workroom, with large window areas, often equipped with diffusing glass, and sometimes supplemented with saw-tooth roofs, permits the fullest possible utilization of natural light.

Artificial Lighting Progress.

It is in the artificial lighting, however, that the greatest progress has been made. The wonderful developments in high efficiency units have greatly enlarged the possibilities of factory lighting during the hours of diminishing daylight and darkness, or in places where daylight cannot penetrate; so that now a proper lighting installation is not only an important safeguard, but an actual economy. Manufacturers who are to-day securing poor illumination with older form of illuminants, can, by a revision of their lighting equipment, procure a good illumination, not only without much additional cost, but in many cases with an actual reduction in the operating cost.

Economic Value of Good Lighting.

The economic value of good illumination, aside from accident prevention, is evident when we consider the greater facility with which an employee can work under good illumination, and the greater accuracy with which gauges can be read and tools set. One large manufacturer, on investigating his lighting conditions, found certain departments in which, during the winter months, the operatives were practically idle for about an hour a day solely on account of darkness.

Good artificial illumination can be furnished in such a factory for eight hours a day at a cost equivalent to about five minutes of the time of the workmen benefited. This illustrates the extravagance of poor lighting. For a great variety of conditions, good illumination reduces the manufacturing costs by increasing production, raising the quality of workmanship and reducing the number of defective parts and "seconds."

Safety Feature.

The question of safety as influenced by illumination presents two phases:—First, the prevention of accidents; and second, the preservation of eyesight. While these two phases are often closely related, there are many conditions in which they are entirely independent of each other. The phase of accident prevention is illustrated in the case of the foundry or other shop where cranes or other powerful machinery are in operation. The liability of crane and elevator accidents is very much reduced with proper lighting.

In the foundries and yards of a plant, is is practically impossible, even with safety committee inspection, to eliminate irregularities under foot. If not illuminated these may readily cause falls, with resulting injuries; and in foundries where molten metal is carried and hot metal abounds, they may often cause serious burns.

Again, even though guarded to the fullest extent, powerful machinery—in which materials are machined and fashioned into articles of commerce, and in which the arms and limbs are as readily crushed—presents a menace unless the operatives are given an opportunity to see and thus avoid the danger points.

Eyesight Preservation Feature.

Although the blind are trained to do remarkable work in certain lines, there is practically no manufacturing operation in which a blind person is not at a disadvantage, while there are so many which cannot be carried on without accurate visual inspection. Some of these operations produce considerable strain even under good illumination, and to require their performance under poor illumination is certain to result in more or less rapid impairment of vision. While economy should in all cases require the best lighting practice, humanity demands it.

Defining Good Lighting.

In view of the preceding, one might very properly ask: "What is good illumination?" and judging from some of the attempts that have been made to solve lighting problems, the conclusion might be drawn that simply a higher intensity of light is the answer. Undoubtedly a higher intensity of illumination is needed in most workrooms, but there are other features of equal and sometimes greater importance. The minimum intensity acceptable generally depends upon the reflecting power of the surfaces to be seen, the fineness of the detail to be observed, the time of observation and the closeness of application. Unless glare be introduced, a higher intensity of light is rarely objectionable, except from the standpoint of cost.

Owing to the remarkable adaptability of our eyes, we are able to get along satisfactorily with very much lower intensities of artificial light than are usual with natural light, and perhaps the best way to consider the other features of good illumination will be to point out some of the most common shortcomings found in factory lighting.

Factory Lighting Defects—Glare.

From my own observations, the most common defect is excessive glare and absense of diffusion. Glare is usually caused by bright lights in the field of vision. This may emanate directly from the light source or may be reflected by a glossy surface; it can also be caused wherever excessive contrast of intensity appears in adjacent fields of vision. The dazzling effect is not only unpleasant, but interferes with seeing. Under continued exposure, eye strain and even permanent injury to the eye may result.

The unshielded light hung over a machine is a common source of eye fatigue. The glare may not be very evident at first glance, but when the workman's eyes have been subjected to such light for a long time, discomfort and inability to see result. The workman frequently complains of insufficient light when in reality the intensity may be higher than is required for the work. In case an attempt is made to meet the complaint by installing a larger light, the workman's eyes are subjected to a still more severe strain. The proper correction should be to shield the light by means of a proper reflector, and as such a reflector would tend to direct more of the light upon the work, the working intensity would be increased; so in many cases it is possible to reduce the size of the lamp, or better yet, to relocate the

*From a paper presented before the American Museum of Safety.
**Edison Lamp Works, Harrison, N.J.

lamp so as to enlarge the area illuminated.

When a light cannot be removed entirely from the field of vision, its briliancy should be reduced by means of a diffusing globe or reflector, so as to increase the apparent size of the light source and reduce the contrast between it and the background. This has the additional advantage of reducing the sharpness of shadows in the illumination, a result which is of considerable importance in rendering the various parts of a machine or other object readily discernible.

Glare received from specular reflection of glazed paper, desk tops, polished metal, etc., often induces eye trouble, headache, and other indispositions; though the sufferers may not be aware of the cause. The remedy is to change the relative positions, so that the reflected light is kept out of the eyes as much as possible, and to enlarge the dimensions of the light source, as already mentioned.

Improper Light Distribution.

Another defect commonly found in industrial lighting is improper distribution. This may be due to too wide a spacing of lighting units. Under this condition some parts of the room are insufficiently lighted while other parts may have more light than is necessary. Improper direction of light may illuminate the wrong side of the machine, leaving the important parts in shadow. If the bright parts are near the shaded ones whatever illumination may fall upon the shaded portion is rendered less effective by contrast. Unsteady or flickering illumination is always objectionable; both on account of discomfort and the inability to see. Such variation should always be avoided, whether caused by the units themselves or by the light passing through moving wheels, etc.

Since the purpose of the lighting is to enable the operative to see, good illumination can not be prescribed until we have some knowledge of the use to which it is to be put. In order to plan the lighting of a factory properly, one should be familiar with the processes employed, the arrangement of the machinery and the work tables, as well as the quality of the product manufactured. Practice has established certain methods of lighting which, if properly applied, are satisfactory for the different processes of manufacture. Thus, we know approximately how much illumination is necessary for the ordinary grade of work as performed on a lathe, as well as the direction desirable. As far as possible, therefore, the experience gained in well-lighted factories should be utilized in planning the lighting installation.

Where extensive lighting problems are to be solved, it is advisable to retain a competent engineer with illuminating engineering experience. However, the following comments on various methods of factory lighting will give some idea of the general practice. Factory lighting has developed along a few fairly definite lines, which may be designated as localized lighting, general lighting, combined general and localized lighting and localized general or group lighting.

Localized Lighting.

Localized lighting originated with the low power portable or semi-portable lighting units. These were under the control of the individual workman, to be placed or shifted wherever he desired. Such lamps were commonly used without reflectors and produced small patches of uneven illumination, as well as more or less glare. In many cases lighting with these lamps is now being supplanted by other methods, on account of the following disadvantages. Lamp breakage is likely to be high, and the expense for installing, energy supply and maintenance excessive, depending upon the conditions and arrangement of work. Moreover, the attention of the workman is called to the lighting and much time is often lost from his regular work in adjusting the lamp.

There are, however, certain operations which require light inside of a small cylinder or other enclosed space; or where very high intensities are required over small areas, and for these no other method is as practicable as localized lighting. For such conditions, the lamp should be equipped with a reflector to shield the workman's eyes and reflect the light in useful directions.

General Lighting.

General lighting came into common practice with high power lamps. Since with these units economy makes a wide spacing necessary, the best method of applying is to equip them with diffusing globes and reflectors, so arranged as to distribute the illumination as evenly as possible. Lamps are hung high, in proportion to their power and the intensity required, and equally spaced throughout the room. The ideal sought is equal intensity over the entire area.

General lighting is provided in three principal ways, which are known as direct, indirect and semi-indirect lighting. With direct lighting, the larger part of the light is distributed directly from the lighting unit to the surfaces to be lighted. With indirect lighting, the light source is concealed and the light thrown upon the ceiling or wall and thence re-distributed for use. With the semi-indirect lighting, the light source is shaded by a translucent reflector and the larger part of the light thrown upon the ceiling or walls for redistribution. Direct lighting, depending upon the equipment, may have excessive briliancy or any degree of diffusion. It is used to a much larger extent in factory lighting because factory ceilings are seldom good reflectors. Direct lighting units are less affected by dust accumulations. The indirect and semi-indirect give excellent diffusion, and are often applied with good effect in offices and drafting rooms when light ceilings are available.

Combined General and Localized Lighting.

Combined general and localized lighting is often desirable. With this, a low general illumination is supplied by large units and more intense localized illumination at particular points by low power units. The localized lighting may be supplied continuously or temporarily as needed. For example, in lighting automatic machinery, a moderate illumination may be sufficient at all times except a machine is being inspected, set up or adjusted, when a localized light may be needed for the particular machine.

Localized General or Group Lighting.

Localized general or group lighting is a recent practice which has sprung up since a range of intermediate sizes of lighting units has become available. This practice differs from general lighting in that, instead of striving for even intensity throughout the room, lamps are arranged to give higher intensities and correct direction of light at the machines or tables and a lower intensity at intermediate points. It differs from localized lighting in being planned so as to give some illumination, sufficient for the needs, in all parts of the room. It is, therefore, an intermediate practice between the extremes of localized and general lighting. Its application is extending very rapidly, since it meets effectively and economically factory requirements for a large portion of the ordinary processes and buildings.

Each of these various methods of lighting has some field in which it is to be preferred to any of the others, and the selection depends upon the character and construction of the building, the process of manufacture, the source of energy available and various local conditions.

That the progress in good factory lighting will be even more rapid in the future seems unquestionable.

While good factory lighting is likely to be made compulsory by law, it is hoped that the manufacturers will be sufficiently awake to their own interests to take any necessary steps of their own initiative rather than through compulsion.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.—VI.

By Albert A. Dowd.

IN our March 11 issue the operations of machining a plain clutch flywheel were illustrated and described, and in the present instance the operations relative to the machining of a cone clutch type flywheel are the feature.

Machining a Cone Clutch Type Fly Wheel.

The fly wheel shown at A in Fig. 6 is perhaps the most common type of automobile clutch fly wheel, and the method of handling it is applicable, with slight variations in the tooling, to a majority

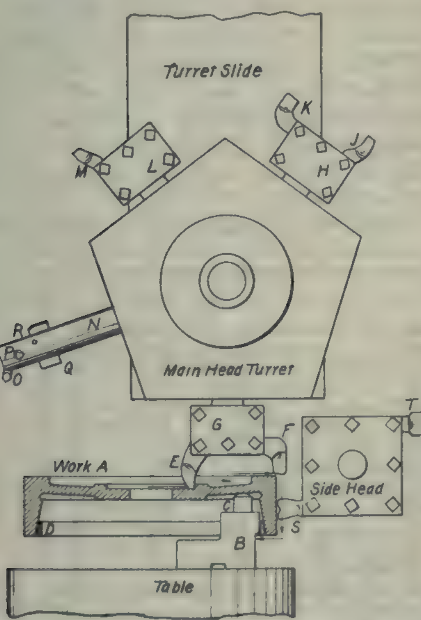


FIG. 6. TOOL LAYOUT, FIRST SETTING.

of the designs of the cone clutch type of wheel. Now, as it is essential that the shouldered portion and the clutch taper be in perfect concentricity one with the other, and as it is difficult to hold the piece by a machined taper surface for the second setting, it follows that the shouldered portion should be machined in the first setting and that this shoulder must be the locating surface from which the taper is machined in the second setting. It will be seen by a reference to the illustration that it would be out of the question to attempt to hold the work by the rough tapered clutch surface, as the angle of the taper would not permit a secure grip on the casting. It becomes necessary, therefore, to add to the pattern an annular chucking ring D, by which the work can be gripped and firmly held.

Having thus provided for the holding, the work is placed over the jaws B, with the web resting on the three buttons or pins C in the upper part of the jaws, the latter being slightly relieved on their faces in order to permit undercutting the rim. As in the previous instance the tooling is quite simple, forged tools being used throughout with the exception of the boring and reaming bar. In the first operation a standard tool holder G is furnished with two special forged tools E and F, which are so spaced as to permit the roughing out of the shouldered portion and the rough facing of the rim simultaneously. The turret is then raised slightly and the tool E used to face the hub. While these cuts are being taken by the main head, the tool S in the slide head rough turns the periphery and undercuts the rim of the wheel.

Both the main and side head turrets are now indexed and the tools J and K used in the tool holder H to complete the finishing of the same interior surfaces as those previously roughed in the first operation, a few thousandths being left at the shoulder for the final sizing cut. The tool T in the side head is used for the exterior finishing. being operated simultaneously with the other tools. It will be noted that the side head tool is so made that it can be utilized for rounding the corners of the rim as well as the finish turning and undercutting.

The third operation is that of sizing the shoulder with the tool M in the tool holder L, this tool being offset an amount sufficient to give the correct diameter when the main head is operating at the centre stop, thus obtaining the size very accurately without resorting to anything very special to accomplish the result.

The fourth and final operation is that of rough and finish boring and reaming the hole with the bar N. This bar is of similar construction to that previously described, having a roughing tool O, a finishing tool P, and a flat floating reaming cutter Q, which is prevented from falling out by the pin R.

This method of handling a clutch fly wheel is both rapid and economical with respect to the tooling, and adaptations of the layout may be readily made to suit a variety of conditions for work of this order.

Second Setting.

A fixture B is shown in Fig. 7, which is utilized for holding the work during the second setting, the fixture being located on the table by the centering plug D, and held down firmly by three bolts G, which enter the table tee-slots. The finished shoulder of the fly wheel is located on the upper portion of the centreing stud at C, and is clamped down on the fixture by means of the straps E and the screw studs F. A refinement which can be introduced in the locating arrangement is the substitution of a hardened and ground locating ring for the unhardened plug shown in the illustration. This ring can be forced on to the large end of the stud, and will stand the wear and tear better than the plain stud,

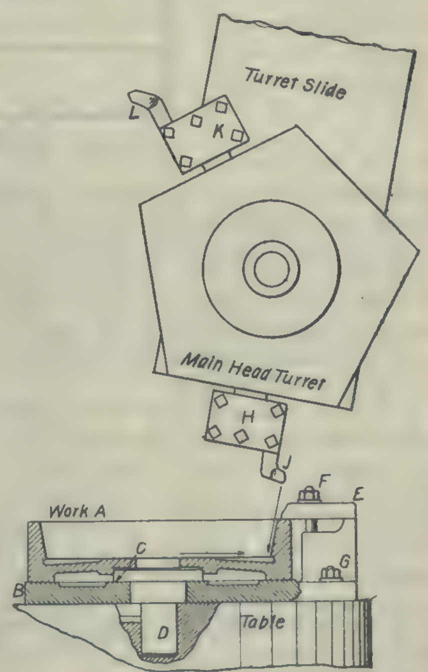


FIG. 7. TOOL LAYOUT, SECOND SETTING.

and in addition to this point, replacements may be easily made.

The only work to be done in this setting is that of facing the hub and machining the clutch taper, and as this type of machine has a swivel head, this is set over as shown to the required taper and left set during all the operations required in this setting. The tool J is held in a regular tool holder H, and is fed down to rough out the taper after which the main head is moved over to the centre and the hub is faced with the same tool, using the transverse feed. For the second operation, the turret is indexed so that the tool L in the holder K is utilized for the finishing, in exactly the same manner as the roughing tools.

It will be noted that the method of

handling illustrated gives perfect concentricity of shoulder and clutch taper, which is the important point for work of this character.

CONTINUOUS MILLING.

By D. O. McDonald.

CONTINUOUS milling is usually associated with the vertical type of milling machine and a rotary positively driven table. This means, of course, that the operation is limited to rather small pieces, as otherwise the rotary table would be too large for the regular machine table. There are, however, many examples of milling machine work, which by proper manipulation may be made practically continuous, using the regular type of machine.

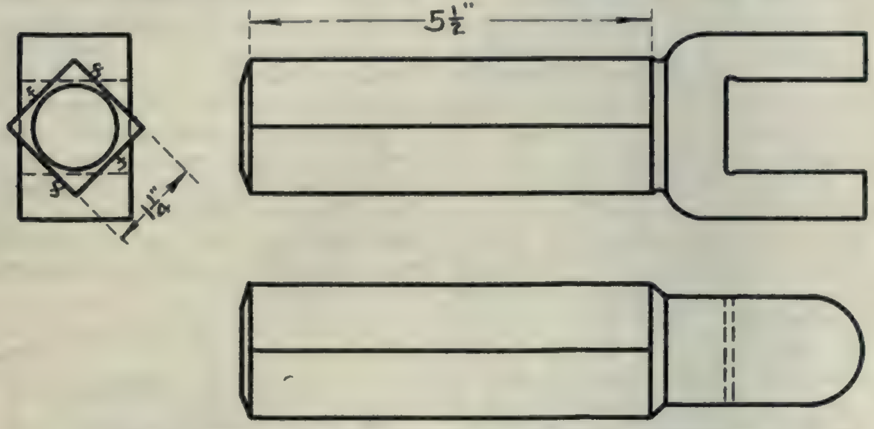


FIG. 1. CAM ROLLER SLIDE FOR STATIONARY GASOLINE

The piece shown in Fig. 1 is a cam roller slide used on a stationary gasoline engine. The stem of this piece is finished on all four sides, the fixture for holding while the milling operation is performed being shown in Fig. 2. The pieces are set on end, being pushed back in the fixture and held by two clamping bolts, which are located at an angle of 30°. As these are drawn up, the head of the bolt serves to clamp the piece in the two directions. The fixture was made of sufficient length to accommodate eleven pieces, and it will be noted that the upper clamping bolt is somewhat shorter than the lower, thus affording clearance for the wrench when tightening same. The openings into which the castings are placed are relieved in the centre and at the bottom, so that there are but two bearing points directly opposite the heads of the bolts. A six-inch face mill was used for milling the sides of these pieces.

The method of operation was to fill the first opening in the fixture and start the feed, the table having been set the proper distance from the cutter, allowing, of course, for the finish on the opposite side. As the feeding proceeded, the operator loaded the remaining positions of the fixture, and then proceeded to take out those that had passed the cutter. The table was then run back by hand with the fixture entirely empty. Pieces were then turned 90° and the entire lot finished on the two sides. After being half completed in this manner, the table was moved up to the cutter so as to give the proper finished thickness, after which the other two sides were completed.

A great deal of time, however, was lost in running the table back and inserting the first piece, the cutter being idle during this entire time. The method adopted later consisted in loading the fixture as before, and as soon as each piece was past the cutter to turn them one-quarter way round and reclamp. When the cutter reached the end, however, it was allowed to run over the last piece sufficient to just clear the one before, so that it could be turned. As soon as this was done, the feed was reversed, and the cutting proceeded as before, only in the opposite direction, the operator stepping to the other side of the table and removing the pieces and inserting new ones. In this manner the cutting was practically continuous, the only time wasted being that necessary for the cutter to run over the last piece sufficiently to clear the one before.

It will be seen that the number of pieces milled per cut is one less than the number which the jig holds. The gain in production in this manner was about 60 per cent. over the previous method, and while the operator was kept on the jump most of the time, yet he did not have to run the heavy table back and forth, so that the work was not as tiresome as formerly.

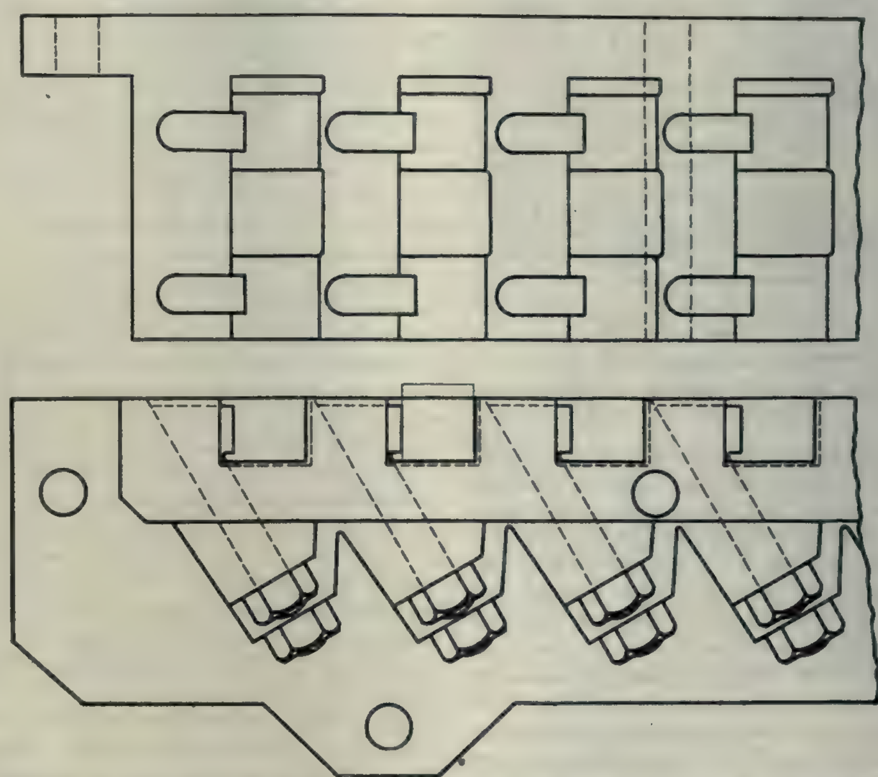


FIG. 2. CONTINUOUS MILLING CAM ROLLER SLIDES FOR GASOLINE ENGINES.

This method of practically continuous milling can be applied to many other jobs on which a face mill is used. Of course, in the one direction there is a tendency for the cutter to lift the table, but where a heavy machine is used and the fixtures are firmly clamped down, this is no disadvantage. Of course, the method is only applicable to the face mill, as this does not tend to hog-in in either direction.

Where it is possible to use this method, the fixtures need not be any way elaborate. The production is practically equal to that of any other arrangement for strictly continuous milling.

CUPOLA DEVELOPMENT AND OPERATION.

By R. Buchanan.

WITH respect to those types of furnace which were drawn in at the bottom, I have made up my mind that this feature was an advantage, and have often debated whether the saving of coke effected was not more than counterbalanced by the cost of the extra labor required in fettling, to say nothing of the risk of hanging up just where the contraction of the contour started.

Receiver Feature.

With regard to having a receiver, opinion among foundrymen is very varied. To my mind the question whether or not a cupola should have a receiver depends largely upon the class of work to be done. A founder who was casting very large cylinders told me that he had worked a furnace without a receiver, but having tried a receiver he would not now do without it. One obvious advantage of a receiver was that a foundry with a particularly small output, but with occasionally a large casting and requiring very clean work, could gather the metal and so utilize the small cupola with advantage in making the large casting. There was thus avoided the necessity of having two cupolas, one of which would be most of the time standing idle. That consideration, to my mind, covered the question, though it is also to be noted that, with a receiver, one can have the tuyeres nearer the bottom than if the metal had to be gathered in the cupola itself. It should, however, be borne in mind that with a receiver more work was required to get the complete apparatus ready for melting than was necessary when there was no receiver.

In the Machiel cupola the receiver was really the bottom part of the cupola. There was a bridge extending over four-fifths of the bottom, and everything was kept up by that bridge. The metal when melted remained in the receiver and was gathered there. I prefer that cupola, as it is possible to get exceedingly hot metal with a comparatively very small expenditure of coke; but the coke and the debris has to be drawn out at the end of the cast, whereas in drop-bottom types the bottom can be dropped, and the cleaning out takes very little time. The Whiting cupola has two rows of tuyeres, whereas the Thwaites has three. The tuyeres in the Whiting are made adjustable, but my experience of adjustable tuyeres is that if we work for a time with one row only and then try to use the second row, they can not be got open.

I consider it an advantage to have a second row, but only big enough to supply sufficient air to burn the gases which were formed below. This is better than letting the gases go up and burn by admitting air at the charging door. The latter was quite a common practice at some foundries, but when one saw a flame 9 or 10 ft. long coming out at the top of a cupola the inference was that the owner either had a lot of money to burn or did not know how to run a furnace. The second row of tuyeres should serve to burn the gases, but not to burn the coke, though it is probable that some of the coke also would be burned.

As far as I know, there is no melting in the cupola now done by gas. In experimenting with the latter some years ago, the ash-bed was filled up with coke and instead of pure air a mixture of gas and air was played on to the bed. I melted 2,800 lbs. practically without wastage of the coke; the cupola melted slowly, but hot, and I took out practically as much coke as I put in. That, of course, was not melting altogether by gas, because a bed of coke was used.

Contour of Linings.

There are many different opinions as to the best form. The tendency is towards a perfectly vertical section, the cylindrical form. One often wishes that we could get the linings of cupolas to last as long as did those of blast furnaces. I have seen a blast furnace which ran for eleven years without relining, but in the more modern blast furnace they are going back more to the type of the cupola. There was no doubt that in a wide blast furnace carbon was deposited on the walls and so preserved them, whereas in a blast furnace of the cupola type no carbon was deposited on the walls.

I had seen only one water-cooled cupola, that in a steel works, and the wastage of the lining there amounted from 12 in. to 15 in. in a week, so that each week the lining, from the melting zone up to the charging door, had to be renewed. In the ordinary cupola frequent renewals are, of course, necessary, but it does not seem that it should be an absolute impossibility to design a cupola, the lining of which would last at least a week without requiring any renewal.

Blast Pressure.

With regard to blast pressure, it has been shown that as the blast is increased the hardness increased. A few years ago it was pretty generally thought that the more air was blown in the better; but that idea was wrong. One foundryman known to me used a 22-oz. blast, his object being to get a very close-grained metal, but in such a case it would be better to select a different metal to begin with and use an easier blast instead of using a soft iron and then hardening it by heavy blowing. On the other hand, another foundry used 1,700 lbs. of scrap to 560 lbs. of pig, and the castings came out quite soft, a 4-oz. or 5-oz. blast being used. That foundry was, in fact, buying coke instead of pig-iron.—From a recent address before the Birmingham Branch of the British Foundrymen's Association.

DOMINION SHELL COMMITTEE REPORT.

A REPORT on the work of the Shell Committee appointed by the Minister of Militia last fall to supervise the manufacture of shells and explosives used in war munitions has been made to the Government. The head of the committee is Col. A. Bertram, and the chief technical adviser is David Carnegie.

The report reviews the committee's work in securing orders for the manufacture of shells in Canada, aggregating up to the present time, it is understood, some $80,000,000, and embracing factories in all parts of Canada. Arrangements are being made at a number of western points to start the manufacture of shells.

The committee reports that all the material being used in the manufacture of shells is, with the exception of copper, being mixed and smelted in Canada. These materials include the shell cases. brass cartridge cases, primers, cordite, powder, and fuses. Thousands of men who would otherwise be out of work are now employed in the various manufacturing processes.

Nearly two hundred examiners and district inspectors have been appointed, under the direction of the Chief Inspector of Arms and Ammunition, to see that the work is being properly done in each factory. Uniform prices are paid, and arrangements have been made to supply the shell-assembling manufacturers with all the component parts of shells free of charge. All kinds of shells up to the eighteen-pounder shrapnel shells are being manufactured.

The committee is now working on investigations in connection with the supply in Canada for the War Office of propellants and high explosives, and also the possibility of filling orders from the Russian Government for rifles and ammunition.

In addition to the manufacture of several thousand tons of cordite and powder in connection with the recent contracts for shells, there is to be noted the utilization of the by-products from the coke ovens of the Dominion Iron & Steel Co. at Sydney, N.S., for the manufacture of the high explosive trinitrotoluene.

The report concludes with the statement that the quality and finish of the shells made in the Dominion are at least equal to those of British manufacture.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

DISEASES OF METALS.

By R. Micks.

THAT certain metals are subject to disease under certain conditions may sound strange to many people, but men who have spent most of their lives in their study will tell you that it is an actual fact that metals become tired and have fatal diseases.

Take the malleable foundry, for instance, in plants where light work is made. There is always an excess of sprues and other hard scrap, and this is melted over and over until it becomes tired or dead, and, therefore, impossible to run light castings with it.

Of course, there is a remedy for this trouble, as the addition of high silicon pig or ferro-silicon in the mixture will bring the metal back to almost its normal state.

There are, however, some metal diseases whose cause and cure science has not yet diagnosed. One of these diseases attacks tin or hard solder having a high percentage of tin in its composition. It is a special disease of cold weather and proves very destructive at about 54 degrees below zero, as parties who have visited the Arctic and Antarctic regions can abundantly testify. It is even more destructive at a still lower temperature. This disease was the cause of Capt. Scott losing part of his gasoline supply in his Antarctic expedition. It seems to affect tin only, slowly changing it into allotropic form as tin powder.

Another one of these freak diseases broke out in a French military store house among the helmets and other articles, which were made of an alloy of copper and aluminum. It first showed up as spots of a light grey color and spread very rapidly. Under the influence of this disease, the metals composing the alloy are changed in proportion to nature, forming a bronze of aluminum. Little holes afterwards appear, and in a short time the object affected falls into complete decay.

Men of science have devoted much time and study to these diseases, but so far have not been successful in either discovering the cause or remedy.

NICKEL AND ALUMINUM.

By E. V. Pannell.*

IT is seldom that we are at variance with the views of your journal, but our attention has been called particularly to the statements of your contributor on page 266 of a recent issue. In making certain claims on behalf of nickel, he draws an invidious comparison with aluminum, involving a number of misstatements regarding the latter metal.

In the first place, aluminum when manufactured in the form of cooking vessels is not a soft metal, except in relation to steel and the hard bronzes.

Secondly, the oxide coating on such vessels is an enamel-like film, hard, stable and neutral, and should not be scoured under any circumstances.

In reference to burning, a very light aluminum vessel on a very hot fire might melt if kept empty. We have never heard in all our experience of any aluminum utensils melting under practical conditions. The statement that aluminum is dissolved in liquid food and forms poisonous metallic salts, we can absolutely deny, and we have ample evidence of tests which have been conducted refuting this contention.

While admitting the wonderful progress made in nickel refining and the wide field opened to this metal, we are inclined to doubt the advisability of employing it in any direction where it is only replacing equally good and cheaper materials. The market price of nickel to-day is 45c and that of aluminum 20c. The lighter metal is, however, only one-third the weight of nickel, so that nickel is just about seven and a half times more costly than aluminum in any manufactured form.

The economy and efficiency of the light metal has already been widely recognized by military authorities in their specifications for canteens and water bottles for which aluminum is now being quite generally employed.

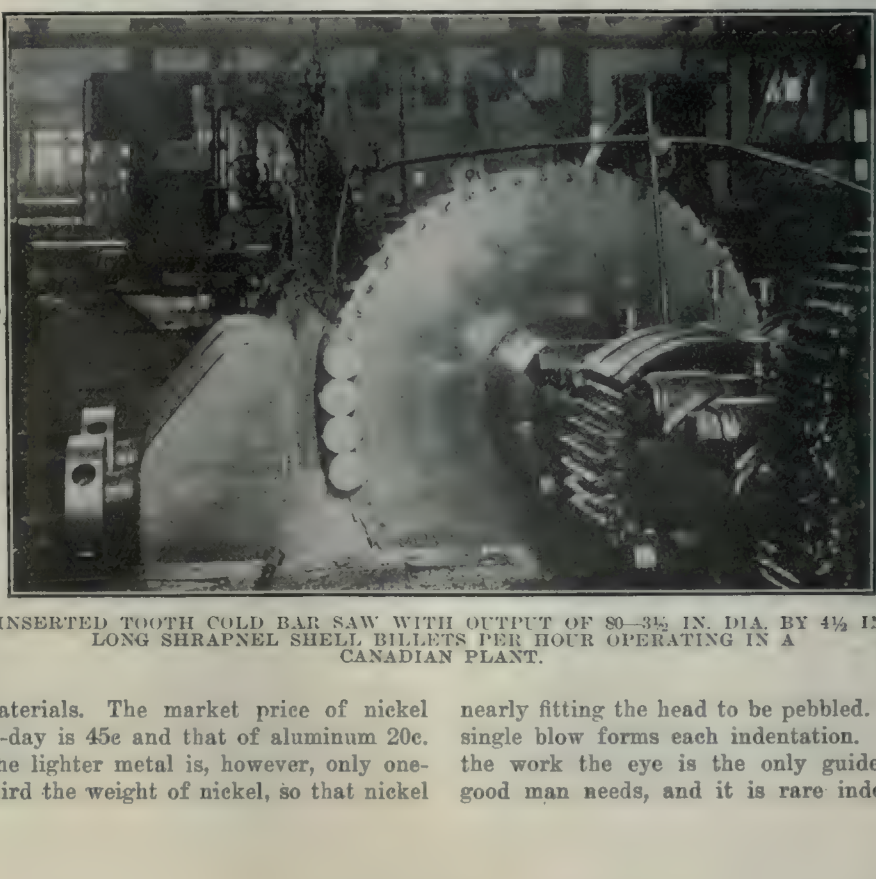
*British Aluminum Co., Toronto.

A TRICK IN FIRE APPARATUS WORK.

By D. A. Hampson.

PROBABLY everyone who has observed fire apparatus has admired the finish of chemical tanks, particularly the highly polished or nickeled heads of such as are pebble finished. Few, however, know that there is utility as well as art in a head so made and that the work is all done by hand.

Chemical tanks are called upon to withstand considerable pressure and flat heads would bulge unless heavily braced, hence they are made of concave form. The head is formed up of heavy copper, and the pebbled or hammered finish is done with a special pein hammer by a skilled workman, who sits before a low anvil on which the head is laid. The anvil is made with a round top, very nearly fitting the head to be pebbled. A single blow forms each indentation. In the work the eye is the only guide a good man needs, and it is rare indeed



INSERTED TOOTH COLD BAR SAW WITH OUTPUT OF 80—3½ IN. DIA. BY 4½ IN. LONG SHRAPNEL SHELL BILLETS PER HOUR OPERATING IN A CANADIAN PLANT.

for him to make a miss. No pattern is used, and a small head is finished in an hour's time.

The hammer blows also have the very desirable effect of stiffening the head by hardening the copper and making it more dense. Manufacturers regularly furnish tanks with hammered heads at the same price as plain heads, though the cost to them is greater.

STANDARDIZATION OF THERMOMETERS AND PYROMETERS.

IN a communication on the Institution of Mechanical Engineers, R. G. Whipple states that the question of standardization is of great importance to all users of thermometers, whether they are employed to measure high or low temperatures.

The boiling points of aniline, 184.1 deg. C.; naphthalene, 218.0 deg. C.; benzophenone, 306.0 deg. C., may all be used for standardization points. Aniline, however, oxidizes readily. Naphthalene is satisfactory, as it is cheap and readily obtained of sufficient purity. This is best tested by taking its freezing-point, which should be 80.0 deg. C. A special, but simple, boiling-point apparatus must be used with both naphthalene and benzophenone. For higher temperatures, it is advisable to use the melting-points of pure metals or eutectic alloys and the freezing-points of pure salts. The following will be found useful and satisfactory points:

Freezing-point of tin, 231.92 deg. C.
Freezing-point of lead, 327.43 deg. C.
Freezing-point of zinc, 419.37 deg. C.
Boiling-point of sulphur, 444.70 deg. C.
Melting-point of antimony, 630.7 deg. C.
Melting-point of sodium chloride, 800 deg. C.
Melting-point of silver, 960.88 deg. C.
Melting-point of copper, 1083.0 deg. C.

In the case of radiation and optical pyrometers, the best way is to sight upon a piece of firebrick or porcelain placed in either a small tube electric furnace or gas-fired muffle. A stardardized thermoelectric couple is mounted either on the face of the firebrick or through a hole in its centre, the pyrometer being focused on the couple. The furnace is then heated and the readings of the pyrometer compared at various temperatures. If a thermo-couple is not available, a single melting-point will be a valuable check on the pyrometer. A triangle is cut out of a piece of thin sheet silver, and one side partly folded over so that the sample will stand up when placed in the furnace. The pyrometer is then focussed on the tip of the triangle, and the temperature at which it melts (960.88 deg. C.) observed.

Question and Answer Series for Foundrymen

Foundrymen having difficulties in connection with their work are invited to forward particulars of them to this department for solution. The greatest possible care will be taken to give only reliable and tried-out advice on all questions and problems submitted for solution.

Question.—What effect does manganese have on babbitt metal? We wish to make a manganese babbitt that will be somewhat similar to the well-known nickel babbitt.

Answer.—Manganese cannot be used to advantage in babbitt metals, as it is so strongly oxidizable as to make the alloy mushy. The addition of less than 1 per cent. of manganese-copper to a tin bronze will convert 25 per cent. of this alloy to a thick slate-colored mush, which shows a purple and gold coloring on top after being plastered into ingot moulds. A few pounds of this mush added to 500 lbs. of melted genuine babbitt metal will cause the ingots to surface ozidize at a low temperature. It can then be poured cool and will assume the rich gold coloring preferred by some makers of babbitt on their ingot metal.

* * *

Question.—We are making yellow brass castings, and have considerable trouble in getting a good color, also in getting them to run sharp. We are using a commercial yellow brass ingot, we watch the metal and temperature as closely as possible, and pour as soon as ready. With all these precautions the castings are rough and curly on the outside. We have tried a little aluminum, but this interferes with dipping, as the acid does not seem to touch the aluminum. We make lots of red brass and have no trouble with it.

Answer.—Have your chemist give you an analysis of your yellow brass ingot, and I think you will find it is either high in iron or very low in tin. This will explain your curly castings and their lack of color. You might also try skin drying your moulds, as this is also a big help when yellow brass runs curly.

* * *

Question.—Will you kindly tell us what you consider the best material for the floor of a foundry? Our product is stove-plate and the floor must be as level as possible.

Answer.—Put in about 5 or 6 inches of cinders or broken stone, level this up with fine cinders from cupola or boiler, and over this put one or two inches of sharp sand. Level with a straight-edge: then lay hard red brick flatwise, and breaking joints lengthwise. Put plank on bricks to keep them from breaking and pound them down so that they are solid and level. Next make a grout of one part cement and two parts sharp sand, and pour it over bricks until all cracks are filled. Leave no cement on surface, except to fill cavities and uneven places. Brick makes a good gangway, as it resists the iron better than anything except clay. Clay gangways are, however, hard to keep even. To make stove-plate true, your floor must be level, and the above composition and arrangement will give the desired results.

* * *

Question.—We use a lot of brazing metal, and would like to make it ourselves. Can you give us a good mixture?

Answer.—The following mixture is extensively used for brazing purposes:—Copper, 87 per cent.; zinc, 12 per cent.; lead, 1 per cent. Zinc is used in preference to tin in making brazing metals, because the copper-zinc alloys possess a certain amount of ductility at a red heat, and do not crumble with the same facility as the copper and tin metals. The color of the metal varies from a coppery hue, with small percentages of zinc, to a reddish yellow, with higher percentages. The structure of the metal is fibrous. The copper should be melted under a cover of charcoal; a little salt being added when the ingots become red. After the copper is melted and appears limpid beneath the charcoal cover, the zinc having been previously warmed, is added in small pieces. The lead is put in next, the mixture thoroughly stirred, after which pouring is in order.

* * *

Question.—Can steel be melted to advantage in a cupola?

Answer.—A few years ago Hugh F. Jones, of Los Angeles, Cal., patented a process for producing steel castings by cupola melting. The method consists of charging the cupola with alternate layers of coke, flux and steel scrap, and the ratios mentioned are from 7 lbs. steel and 1 lb. of coke, up to 10 lbs. steel and 1 lb. of coke. The coke should be coarse, and the prices of steel should not exceed 25 lbs., the smaller pieces being charged first. Open-hearth steel should be used when the castings are to be machined, but if not, the charge can consist of 75 per cent. Bessemer steel and 25 per cent. open-hearth scrap. The flux, which principally consists of silica and iron oxide, is used in the proportion of 10 lbs. to

each ton of scrap when the coke contains 2 per cent. of sulphur. For each 1 per cent. of sulphur over or under 2 per cent., one pound of flux is added or deducted. The blast used depends on the percentage of fixed carbon in the coke; thus, for 70 per cent. fixed carbon, 8-ounce pressure is used, and for each 5 per cent. above or below this, the blast is reduced or increased 1 ounce. Additions of aluminum and ferromanganese are made in the ladle.

* * *

Question.—We have trouble in getting a sand match that will stand the wear and knocking around to which it is subjected in the foundry. Could you advise us of any good mixture for this purpose?

Answer.—If you will try the following I think it will be satisfactory in every way:—Finely sifted gangway sand, 89 parts; finely sifted steel or iron borings, 1 part; pulverized litharge, 3 parts; boiled linseed oil, 7 parts. Mix the sand, borings and litharge when dry, taking care to keep out all moulding sand, gravel or water. After thoroughly mixing, add the 7 parts boiled linseed oil, and mix to the same temper as moulding sand. Ram this mixture into your cope-match or frame, and secure firmly with screws in preference to nails. A match made with this mixture will last for years if given half a chance. A coat of shellac and lampblack when it is dry will also help this match.

* * *

Question.—Please inform us in your columns devoted to questions and answers which you consider the best lining for a cupola. We are lining a new one, and we are undecided whether to use stock brick or cupola blocks.

Answer.—Cupola blocks require less labor and fireclay to build a lining than stock brick. A more uniform diameter to your lining can also be secured by using blocks, as there is a smaller number of joints in the block lining. It is, therefore, evident that it will outlast a lining made of stock brick, all things being equal in the material of which both are made. Have your lining divided into four or five sections, supported by rings of angle iron attached to the cupola shell. This will give you a chance to repair your melting zone without disturbing the other sections of your lining, as the melting zone burns out much more rapidly than the rest of your lining.

* * *

Question.—Kindly give us a good formula for phosphor bronze?

Answer.—The term phosphor bronze is rather vague, as it is applied to a large number of alloys of widely different compositions. When used for the purpose of a bearing, it contains a considerable percentage of lead. The following is a good bearing alloy:—Copper, 81 per cent.; phosphor-copper (15 per cent.), 3 per cent.; tin, 7 per cent.; lead, 9 per cent. Melt copper under charcoal and, when thoroughly liquid, add phosphor-copper. Let the metal stand a few minutes with furnace covering partially removed, then add tin and lastly, the lead; afterwards stir vigorously. Of late there has been a tendency to confine the term phosphor-bronze to the strongest grades of copper-tin alloys, thus indicating by the use of this name that a bronze is required possessing the highest physical properties possible in a copper-tin alloy. A good formula for such an alloy follows:—Copper, 90 lbs.; tin, 5 lbs.; phosphor-tin (5 per cent.), 5 lbs. Add phosphor-tin first.

COMING CONVENTIONS.

National Metal Trades' Association, Hotel Astor, New York.—April 12-15.

Southern Supply and Machinery Dealers' Association, Atlanta, Ga.—April 14-16.

National Association of Manufacturers, Waldorf-Astoria, New York.—May 18-19.

National Machine Tool Builders' Association, Atlantic City, N.J.—May 20-21.

Master Boiler Makers' Association, Chicago, Ill.—May 26-28.

American Iron, Steel and Heavy Hardware Association, St. Francis Hotel, San Francisco, Cal.—May 25-28.

American Supply and Machinery Manufacturers' Association and National Supply and Machinery Dealers' Association, Hotel Bellevue-Stratford, Philadelphia, Pa. (Joint convention.)—June 3-5.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Railway Supply Manufacturers' Association. Convention and exhibit in conjunction with the Railway Master Mechanics and the Master Car Builders.—June 9-16.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

TORONTO BRANCH, AMERICAN ELECTRO-PLATERS' SOCIETY.

THE Toronto Branch of the American Electro-platers' Society extend a cordial invitation to all interested in the electro deposition of metals, to be present at their meeting in the Occident Hall, corner Queen and Bathurst streets on Thursday, April 22, at 8 p.m. The following interesting program has been arranged:—

J. T. Burt-Gerrans, of Toronto University, will lecture on the electrolysis of copper solutions, using a projecting lantern and copper bath in operation to demonstrate the electro-chemical action which takes place during deposition of metal. Mr. Burt-Gerrans is a very fluent and energetic speaker, besides being an authority on the subject he will present.

Mr. Morrison also of Toronto University, will speak on the advantages of a training in electro-chemistry as applied to electro-plating. Mr. Morrison is instructor in the electro-plating class at the Toronto Technical School, and having had practical experience in electro-plating work, his remarks will be of particular value.

W. S. Barrows will describe the uses and advantages of Cobalt electro deposits, giving a brief historical sketch, also explaining in non-technical terms the results of his extended experiments relative to this neglected metal. Mr. Barrows will illustrate his paper with a display of ores, oxides, and salts of cobalt, also specimens of various lines of goods plated with metallic cobalt. This feature will be particularly valuable to the manufacturers of plated goods, as well as to the nickel plater.

Cobalt is rapidly becoming prominent as a metal substitute for nickel, and as it is comparatively new in the electro-plating industry, a special request is extended to those operating nickel plating plants to attend this meeting. The society desires a good representation from the metal section of the Toronto Branch, Canadian Manufacturers' Association, also from such other bodies as are in any way interested in the commercial electro-deposition of metals.

Welding Steel.—Cast steel:—borax 64, salammoniac 20, ferro-cyanide potassium 10, rosin 5. Boil all with some water, constantly stirring until homogeneous compound is formed. Then dry out slowly in same vessel. Welding is done at light yellow heat or towards white heat.

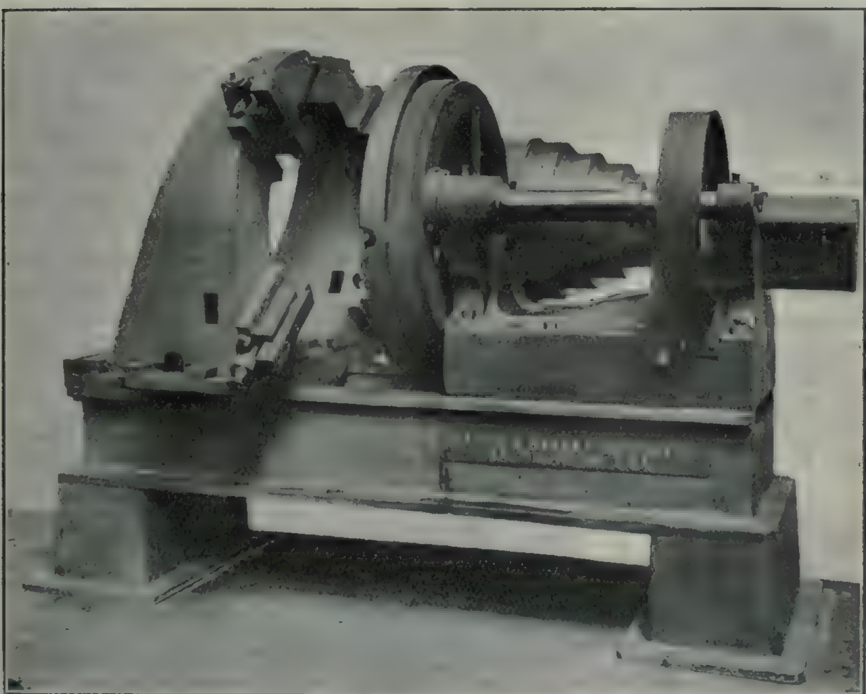
PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

FLANGE FACING MACHINE.

THIS machine is designed for facing the flanged ends of large pipes, and consists essentially of three parts: a threaded head-stock carrying a rotating facing head, a vise or rest for holding the pipe to be faced and a bed for supporting the parts.

The headstock is similar in design to an engine lathe headstock and has a cone pulley and back gears for driving the spindle. Mounted on the front end of the spindle is a large face plate having a slide way and a tool slide which has an automatic feed from the periphery of the face-plate to the centre. The feed is obtained by means of a shaft extending through the hollow spindle. This shaft is driven from the rear end of the spindle by differential gearing, and in turn drives through bevel gears the feed-screw which operates the tool slide. A clutch is provided for disengaging the feed. The spindle is provided with bronze bushed adjustable bearings and an adjustable thrust bearing.



FLANGE FACING MACHINE.

The device for holding the pipe consists of a carriage mounted on the bed, having an adjustment to and from the facing head by means of a crank handle and screw, and a pair of vise jaws resembling a lathe steady rest, but made in halves and operated by a right and left-hand screw to facilitate the rapid chucking and removal of pipe. The rests or vise jaws are fitted with four lesser radial jaws having an adjustment for varying diameters of flanges. A swing locking bolt is provided at the top for clamping the rests.

The machine, which can be equipped with a small crane for supporting the outer end of the pipe, is built in two sizes, one having a capacity up to 24 in. and a larger machine having a capacity up to 38 in. There are five or six changes of speed of sufficient variation to cover the entire range of work. The small machine has $2\frac{1}{2}$ in. belt on cone and the large machine a 4 in. belt. A removable device which fits in the end of the spindle is provided for squaring up the work in chucking. A counter-shaft with tight and loose pulleys is also supplied.

Detrick & Harvey, Baltimore, Md., are the manufacturers of the above described products.

TURRET LATHE OUTPUT.

IT is a mistake to imagine, says the Alfred Herbert, Ltd., "Monthly Re-Review," that the installation of modern high-class labor-saving machine tools solves the question of high output and low cost. Machines can be as well made as it is possible to make them, and may embody every possible convenience and appliance for easy handling and multiple tool cutting, and still their output may be low. In order to secure the best results, it is important that the personnel should be of the proper class, that the auxiliary equipment of the shop should be complete, and that the organization of the shop should be suitable to the machine tool and auxiliary equipment, to the personnel, and to the character of the work to be done.

Training the Operator.

Dealing first of all with the workmen, it is important that they should be suitably trained in the use of the machines thaey have to operate, for many troubles and losses of outputs have been caused by owners of shops expecting too much from untrained men. So-called untrained men often do a good deal of damage before they become efficient, whereas a little help and training can frequently be provided by the owners of the workship with very great advantage to the output of the machines and to the accuracy of the product. To this end, it is essential that the management should include someone with a complete knowledge of the possibilities of and methods of operating labor-saving machines. This is no less important in the case of turret lathes than of other machine tools. Another requirement is that the workshop should be such that good men will be comfortable and content to remain in it, as constant change of the workmen causes dislocation and reduction in quantity of product.

Maintenance Equipment.

Another essential in the case of turret lathes and automatics is that the workshop should contain the necessary staff and plant for making and maintaining tools. We have known instances of workshops equipped with the most complete and expensive batteries of turret lathes and automatics, but without an efficient tool grinder, and in such a case the purchase of a cheap tool grinder frequently enables the output to be increased more than by the purchase of several additional automatics. Assuming that all the requirements in the way of workmen, supervision, and plant are provided for, good organization is necessary if waste is to be avoided, for unless cutters are kept in stock already ground, much time will be lost by the operators.

Organization Features.

The organization should also include the provision of proper means of in-

specting the work as it comes from the machines, and the manufacture and maintenance in an accurate condition of the necessary gauges and measuring appliances. Provision should also be made for the efficient transport of the work to and from the machines, and this should not be done by the operators, who should have nothing to do but operate their machines where the best output is required.

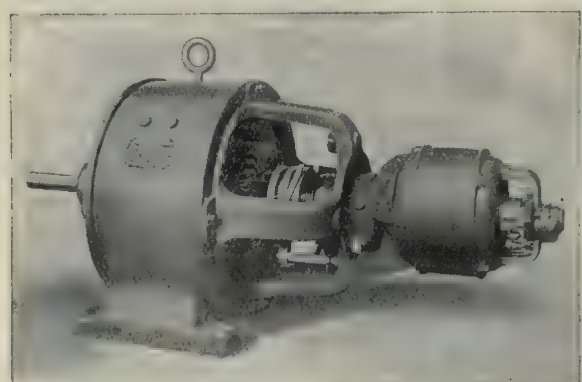
In dealing with the men on the machines, the prices of work should be arranged so as to give the workmen an opportunity of earning good bonuses by good industry, and in many cases it will be found to be satisfactory to organize the men in gangs so as to equalize the profits or losses accruing from various machines. As makers of labor-saving machine tools, it has been disappointing to us in many cases to know that the output of the machines in some works is not what it could easily become if the matters indicated above were fully appreciated.

SMALL BELTED ALTERNATOR.

THE term "Generator" to many minds brings up the vision of huge turbo-alternators, equipped with the most elaborate devices to ensure absolute reliability, yet there are hundreds of small plants, the demand of which does not warrant the use of such huge units but where reliability is just as important.

For such service the Westinghouse Electric and Manufacturing Co., Pittsburg, Pa., has perfected a small belted alternating-current generator, with direct-connected exciter. Such an arrangement makes a very compact unit, as well as securing the highest degree of reliability and independence of operation.

This generator has a rated capacity of 20 kva. 3-phase, or 14 kva. single-phase.

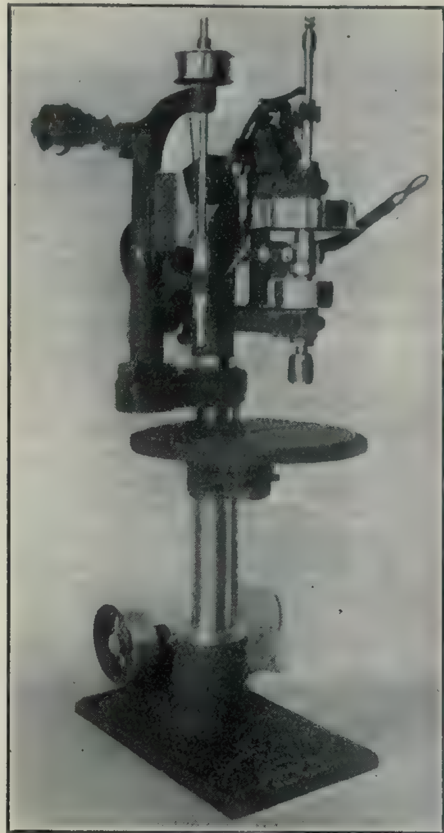


SMALL BELTED ALTERNATOR, 20 K.V.A., 3-PHASE, 60-CYCLE, 240-VOLT, 1800 R.P.M.

The standard frequency is 60 cycles at a speed of 1,800 r.p.m. and the machine is furnished to give either 120, 240, 480 or 600 volts.

COMBINATION DRILL AND AUTOMATIC TAPPER.

THE illustration shows a combination drill and automatic tapping machine, a product of the Garvin Machine Co.,



COMBINATION DRILL AND AUTOMATIC TAPPER.

New York City, and an addition to their well-known line of automatic tapping machines. The drill head is applied to their standard No. 2 automatic tapper, is driven by a separate countershaft, and has a capacity of driving a ½-in. drill.

The tapping machine has a capacity of ¼ in. to ¾ in. U.S.S. tap in cast iron, and is automatic in its operation, as soon as the work is started.

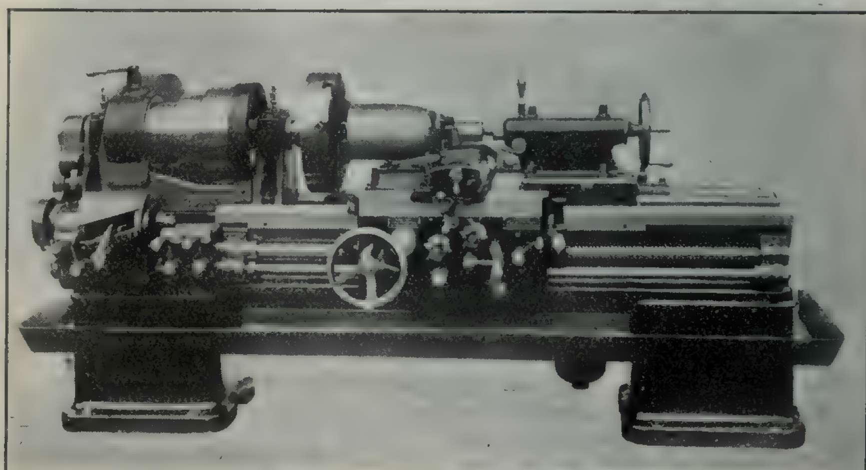
The combination makes a very handy tool, as work can be drilled and tapped without going from one machine to another.

GRAPHITE AND STRENGTH OF CASTINGS.

THE deleterious effects of graphite were emphasized by Dr. J. E. Stead in a recent lecture in Birmingham, England, on "Some Scientific Features of Cast Iron." He described graphite as the enemy of the foundryman, and likened it to thin plates of mica which can be split along their cleavage planes with the utmost ease. He summarized the results of a large number of tests, undertaken with a view of ascertaining the influence of graphite on the strength of castings, in the following table:

Graphite, per cent.	Transverse strength, cwt.	Tenacity, tons.
3.00 to 3.25........	20.4	8.25
2.600 to 2.85	27.1	13.24
2.15 to 2.55	31.9	14.54
2.00	40.0 above	17.10
None, with 3 per cent. silicon	91.0	88.60

He deprecated the rule-of-thumb practice which has led foundrymen to adopt a hostile attitude towards types or grades of pig iron with which they were unfamiliar, citing the case of some irons of superlative quality which were unsalable and had to be reinserted because their fracture presented some unusual features. He argued that any class of iron could be made to yield the results desired if only it were "mixed with brains"; that even sulphur, sometimes considered the foundryman's worst enemy, could be turned to useful account if intelligently handled. This element should rather be regarded as a friend, said Dr. Stead, because it prevents the carbide from parting with its graphite.



20-INCH AMERICAN HIGH DUTY LATHE ARRANGED FOR THE PRODUCTION OF ARMOR-PIERCING PROJECTILES AND SHRAPNEL.

The MacLean Publishing Company
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Vol. XIII. APRIL 22, 1915 No. 16

PRINCIPAL CONTENTS.

THE LABOR PURCHASING DEPARTMENT.

WE are informed upon the very best authority that the average labor cost of machine shop products runs from 50 to 75 per cent. of the ultimate cost. The employment office, however, is often but the more dignified appellation of the gatekeeper's shelter or, the taking on of men may be one of the duties of an already overworked receiving clerk, and this official, to save his precious time, is generally equipped with display signs indicating the exact character of help required, in addition to that which says "No Help Wanted To-day." The foreman of a department is required to inform the gatekeeper of the class of men wanted and the wages to be paid, and here his responsibility ends until the new help appears, to be made the best of.

When a plant has grown to certain proportions, it is obviously impossible for the manager or superintendent to devote his time to the details of careful hiring of men any more than he can give his whole thought to the best market quotations on material. The employment department, which really represents the greater investment, should therefore be in the hands of a thoroughly competent and responsible man whose duties do not end with the hiring stage. He should follow his proteges' installation in the plant, should determine their efficiency and rating and should represent the last court of appeal between man and foreman.

There are numbers of little disagreeable jobs in connection with the rating and disciplining of help that are detrimental to the influence of the foreman with his men if he be required to perform such duties. The proper man to do this work is the man who does the hiring. Carelessness in the choosing of men is liable to result in the getting of careless employees. The quality of workmen is many times more valuable than the price or quality of material, and it is safe to say that the man who shrewdly controls the quality and efficiency of the human element holds the real guiding reins in the destiny of the institution.

MAINTAINING SUFFICIENCY OF TRAINED MECHANICS.

IN connection with the recent discussions on the losses entailed by employers in replacing trained mechanics who have been discharged or otherwise lost to the organization, the side of the men themselves deserves some consideration. Take the apprentice who often becomes more proficient in the handling of certain machines than the specially hired operator, we find the instances where he is provided with a practical demonstrator or any kind of technical instruction decidedly few, it being usually a case of apprentice learn from apprentice or pick up what he can from more or less indifferent journeymen. The average ambitious young man therefore looks forward to the time when he will be free to explore new fields in his chosen trade or occupation and acquire the knowledge worth while which will secure him higher degree remuneration.

There are some notable manufacturing concerns who make a practice of developing their own skilled help and raising up their own department heads. In these cases the plants are large, involve the best practice in their respective lines and are in a position to provide better conditions for their older hands than these could perhaps obtain elsewhere. Still, more cases have come to our attention where strangers brought into the plant are paid more than the men who have spent the best years of their lives with the institution.

Again, if men are to be kept indefinitely in the same shop at the same work, and if no new blood be brought in, there will have to be some powerful influence on the part of the management to prevent a gradual slackening of interest and zeal and consequent efficiency in the work. The machinist does not get the highest mechanics' wages by any means, and the ability to travel and educate himself is one of the things he gets besides his money that helps to make up.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.10
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 50
Copper, unch-bled, heavy	12 00	12 50
Copper, wire, unch-bled	12 00	12 50
No. 1 machine compos'n	10 00	10 50
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 50	10 00
No. 1 brass turnings	7 00	7.50
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	64	47	....	....
½ in.	69	56	....	....
¾ to 1½ in.	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in.	74	61	73	60
4½, 5, 6 in.	....	....	72	59
7, 8, 10 in.	....	....	68	56
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2 in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	41	....	....
½ in.	63	50	....	....
¾ to 1½ in.	68	55	....	....
2 in.	68	55	64	51
2½, 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in.	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$17 75	$17 75
Electrolytic copper	17 50	17 50
Castings, copper	17 25	17 25
Tin	52 00	56 00
Spelter	12 50	12 00
Lead	5 65	5 75
Antimony	25 00	25 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in	3.20	....	....	....	....
10 in	3.50	....	....	....	....
10 in	4.12	....	....	....	....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.75
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.73
Linseed oil, raw, single bbls.	0.78
Linseed oil, boiled, single bbl.	0.81
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. (galvanized	4 50	4 50
Queen's Head, 28 B.W.G.	4 60	4 60
Fleur-de-Lis, 28 B.W.G.	4 30	4 30
Gorbal's Best, No. 28	4 60	4 60
Viking metal, No. 28	4 20	4 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07½
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., April 19, 1915.—The general business outlook throughout the province is improving steadily with the early spring weather, and this improvement is being reflected to a greater or less extent in the building and metal working industries. Coincident with this, there is the opening of navigation, which also tends to improve all lines of business generally. It seems as if the whole situation is unprecedented. The demand for products which in times of peace are greatest seems to have disappeared, and other products are called for in their place. These new products are practically all for use in the manufacture of the munitions of war. Thus nearly all the activities in shops are of a variety which have rarely been undertaken in Canada before.

The machine tool problems are quite as complex as heretofore. It would appear now that as long as the demand for ammunition keeps up, the demand for tools capable of making steel shells, cartridge cases, time fuses, etc., will also be present and will be so as long as the war lasts.

The interrupted shipping on the high seas has a tendency to upset the metal markets in America to no little extent. However, new channels are being opened

up for consumption. Fluctuating prices as a result are the main features of the metal exchange.

The Steel Market.

Trade in building sections is improving slightly, but at that business is far below normal. The demand for merchant bars is also small, although the commencement of the manufacture of the high explosive shells in Canada has created a demand for certain sizes of round bars. The shops engaged in the manufacture of tools from high-speed steel are very busy making special jigs and fixtures for the rapid production of shells of the various sizes. The actual tonnage of steel consumed at present is, however, away below normal, and a great deal of improvement must be made before trade can be considered satisfactory.

Pig Iron.

As the foundry business is extremely quiet, little or no trading in pig iron is being done. Prices remain unchanged, there not being enough business to properly adjust them.

Machine Tools.

In the machine tool trade the usual activity in turret lathes still continues to occupy the attention of most dealers. In order to assist manufacturers, many well-known firms are marketing special jigs and fixtures which can be fitted to standard machines to be used in the manufacture of shrapnel shell cases. A lively demand for such tools has existed for some time past, and manufacturers of machine tools, like most other people connected with the engineering profession, did not realize to what an extent this feature would be developed.

Thus, many shops have been thrown on their own resources, and have gone into the matter in a systematic way, and have designed their own tools and fixtures, finishing them up in their own shops. Many firms have been experiencing a shortage of forgings, and have undertaken the work of installing hydraulic presses to manufacture these. Activity in the machine tool business is for the most part centred around the shell-making industry. Certain tools such as reamers, taps, gauges, etc., are also largely in demand, the various types and sizes of shells being manufactured bringing this about. Other supplies also are moving more or less rapidly.

Metals.

The demand for copper seems to be on the increase, and the production seems to be a little behind. Smelters working the lower grades of ore have not been operating for some time past, and it is not likely that they will commence because of the fact that it is largely a speculative proposition as to how long the higher prices will continue. Whether the demand is a normal one or not, it is not known.

A great deal of tin is afloat, bound for the American market, and this, together with the fact that considerable tonnage has already arrived at American ports, has caused the price to sag. Spelter is a little stiffer, while lead is quiet.

The shortage of antimony is being again felt, and recent demands have caused the price to rise again.

Aluminum is very quiet.

Toronto, Ont., April 20, 1915.—Industrial conditions generally are showing some improvement and a more optimistic tone prevails in business circles. The orders for war equipment are largely responsible for this, although at the same time, the outlook is better as regards ordinary trade. The opening of navigation will stimulate business to some extent, especially shipments to Western points.

Steel Market.

There is little change to note in the steel trade this week, although the outlook is improving to some extent. Orders for lyddite shells are being distributed and there is a corresponding increase in the demand for round steel bars for this purpose. There is also a steady demand for steel forgings for shrapnel shells, the mills working to capacity to meet the requirements. It is reported that the Dominion Steel Corporation's export business is improving for both war supplies and general lines. The plant is working at 70 per cent. capacity. The building trade is quiet and indications do not point to any marked improvement for some time, consequently the demand for structural shapes is light. There is a little better business moving in merchant bars but it is under normal. Prices are unchanged but firmer.

Conditions in the steel trade in the United States are slowly improving. Prices are very firm, the leading mills quoting 1.20c on bars and shapes for delivery up to July. Large orders for shrapnel shells have been distributed and considerable export business is being done in other lines. Steel works are operating on an average of between 65 and 70 per cent.

Pig Iron.

The market continues in a dull condition with foundries working at considerably reduced capacity. All old country brands of pig iron have made sharp advances in price, which will to a large extent eliminate them from this market. Local quotations on domestic brands are unchanged.

Machine Tools.

Shell machinery continues to dominate the market, although not to the same extent as earlier in the year. Some difficulty is still being experienced in obtaining satisfactory deliveries, which is having a tendency to hold up business. Second-hand tools suitable for shells are also in active demand. Enquiries being received now by local dealers are principally for lathes and heavy drills for the lyddite shells. The woodworking machinery business is quiet, but the demand for tools for general purposes is picking up, several good enquiries having been sent out during the week.

Supplies.

The improvement in the demand for machine shop supplies continue, although orders generally are for smaller lots than usual. An advance of 2c in turpentine is noted and quotations are firm at 73c per gallon. Linseed oil declined 2c and is now quoted at 78c for raw oil. Other lines are unchanged.

Scrap Metals.

The scrap metal trade is quiet but prices are firmer all round. Copper and brass scrap have advanced 1c and ½c per pound, respectively, due to the strength in the copper market.

Metals.

Business in the metal market is gradually picking up, but is still of the hand-to-mouth order. There is an increasing demand for copper, lead and antimony, especially the former, for war munitions, the market consequently is very strong. Some relief is expected in the tin situation, but the market is still very unsettled.

Copper.—The enormous demand for copper for war munitions continues and is reflected in the market, which is very strong. The consumption of copper for war materials cannot fail to go on increasing for some time to come. In the local market copper has advanced ½c and is very firm at 17¾c per pound.

Tin.—The market for spot tin is still very unsettled but there is a possibility that the British Government will withdraw some of the restrictions recently placed on the export of tin, at least as far as the States is concerned. This will relieve the situation considerably. Spot tin is scarce but supplies of futures are ample. Quotations are nominal at 54c per pound.

Spelter.—The market is unsettled and supplies are scarce. Qpotations are nominalat 12c per pound.

Lead.—The demand from Europe continues large and the market is firm. Prices are unchanged at 5¾c per pound.

Antimony.—The market is strong on heavy demand. Prices are nominal and unchanged at 25c per pound.

Aluminum.—Quotations are unchanged at 23c per pound.

Trade Gossip

Cost of Flour Contribution.—Canada's 1,000,000 bags of flour to England cost the Trade and Commerce Department $3,005,540, purchases having been made as follows: Western Canada Flour Mills, Ltd., $350,000; Dominion Flour Mills, Ltd., $56,000; Lake of the Woods Milling Co., Ltd., $280,000; Maple Leaf Milling Co., $1,164,842; St. Lawrence Flour Mills Co., $112,000; Ogilvie Flour Mills Co., $840,000; ocean freight and insurance, $201,828; rent of harbor and shed, $825; printing bills of lading, checking, etc., $44.

Machine Guns Gifted.—J. B. Fraser, the Ottawa lumberman, has donated two additional machine guns to the machine gun section of the 8th Canadian Mounted Rifles. The section will thus be increased from a two-gun equipment to a four-gun equipment, and will be under the command of Lieut. Fraser, second son of the donor. Mr. Fraser has already given one machine gun, while the Militia Department provided another to the section. Lieut. Hugh Fraser, another son, is at the front with the first contingent, and was an officer in the Governor-General's Foot Guards.

Production of Molybdenite.—The Ontario Department of Mines has received inquiries from the Imperial Institute, London, with regard to the production of molybdenite in Ontario. This metal is at present much in demand in Britain for steel-hardening in the manufacture of armaments. The names of producers and samples of the deposits are asked for. Molybdenite exists in quantities in northern and eastern Ontario but as yet there has been no commercial production of this metal, which it is now hoped may be stimulated by the market now opened. Tungsten is also required in England for steel hardening to replace the supplies formerly obtained from Germany, and the Provincial Mines Department is making an investigation to ascertain whether the industry can be developed in Ontario.

Russian Government Shell Order.—The big order recently received by the Canadian Car & Foundry Co. from the Russian Government calls for 2½ million high-explosive and 2½ million shrapnel shells, the contract price running to over $80,000,000. At the present time negotiations are proceeding with some twenty-five Canadian manufacturers as subcontractors for the production of approximately one million shells. Delivery of the whole is called for by January 31, 1916. On account of Canadian firms being almost fully employed meantime on the manufacture of British 18-pounder shrapnel, the bulk of the Russian order will of necessity be placed with U. S. firms.

Brantford, Ont.—The Hydro-Electric Commission are calling tenders for a large addition to the sub-station here.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Ottawa, Ont.—Cowie & Moore have let several contracts for their proposed machine shop here.

Brantford, Ont.—It is announced that the Ker-Goodwin Co. have received an order for shrapnel shells.

Hamilton, Ont.—It is announced that the Canadian Horseshoe Co. will begin construction of their new plant very shortly.

Sackville, N.B.—The Fawcett foundry which has been closed for some months will, it is expected, resume operations shortly.

Cobalt, Ont.—It is reported from Timmins that plans are under way for the construction of a stamp mill for the Acme property.

North Bay, Ont.—It is rumored that a party of New York capitalists has taken over the Trout Mills smelters. A large gang of men have been put to work repairing and fitting up the works.

Cobalt, Ont.—The news has reached here of a fire at the Miracle Mine, in Langmuir Township, causing much damage and seriously hampering operations. The power-house and its contents were totally destroyed.

Dauntless, Alta.—The Dominion Harvester Co. will establish a plant here. Tenders will be called shortly for machine tools and machine shop equipment. Gilbert Hunt of Walla Walla, Wash., is interested. The general contractors are the Hunt Engineering & Sales Agency, Los Angeles, Cal.

Chatham, Ont.—It is reported that a million-dollar sugar beet factory will be built in Chatham this year by the Dominion Sugar Co. of Wallaceburg. A site has been purchased and work will be started as soon as a by-law granting concessions has been carried. The council will be asked to provide part of the site to the value of $18,500 and give exemption from taxes for ten years.

Electrical

Almonte, Ont.—A report is being prepared by O. F. Adams, of the Hydro-electric Commission, on the development of a power plant here.

Weyburn, Sask.—The installation of a fire alarm system has been approved by the city council.

Vancouver, B.C.—The city council of North Vancouver are contemplating installing a water wheel and generator.

Owen Sound, Ont.—The plans of the transformer station for the hydro-electric will be here soon, according to Secretary J. Parker, of the Utilities Commission. When the plans are all received it is the intention to ask tenders on the work on construction.

Municipal

Peterborough, Ont.—Work has been started on the construction of a sewage disposal system.

Richmond, B.C.—The city council contemplate extensions to the waterworks system at a cost of about $40,000.

Weyburn, Sask.—The city council are considering the purchase of a booster pump for fire protection. A 12-in. water main may also be installed.

Lindsay, Ont.—The by-law to guarantee the bonds of the Canadian Boving Co., Ltd., was voted on here on April 14 for a second time and defeated.

Swift Current, Sask.—A by-law is contemplated for raising $75,000 for completion of the electric light and power plant.

Kamloops, B.C.—Ducane, Dutcher & Co., engineers, of Vancouver, are preparing plans for proposed extensions to the street lighting system.

Ridgetown, Ont.—The Town Council has unanimously decided to submit a by-law to the people calling for the installation of a Hydro-Electric system.

Montreal, Que.—The contract for the proposed civic library at Lafontaine Park will most probably be awarded to Quinlan & Robertson for $461,000.

Montreal, Que.—The plans for the proposed extension to the filtration plant will be prepared here from data furnished by the engineers, Hering & Fuller of New York.

Ridgetown, Ont.—The council has adopted the Hydro Commission's report for a new lighting system. A by-law will be prepared to authorize the estimated expenditure of $12,000.

Three Rivers, Que.—The city council have engaged R. S. and W. S. Lea, consulting engineers, Montreal, to prepare a report with regard to improvements to the waterworks system.

Toronto, Ont.—Tenders will be called for a reinforced concrete bridge over the Belt Line tracks on Mount Pleasant Road. This is an alternative proposition to a steel bridge previously decided upon.

Toronto, Ont.—The Board of Control has decided to recommend that the report of Commissioner Wilson regarding the incinerator be adopted. This means the acceptance of the tender of the Canadian Griscom-Russell Co., of Montreal, at $49,200.

Verdun, Que.—The city council has passed the first reading of a by-law to permit the issue of $400,000 debentures. Part of this, amounting to $75,000, will be spent on waterworks and electric light extensions. Water mains and sewers, etc., will account for $25,000.

General Industrial

Lethbridge, Alta.—A tannery is being built here by a Mr. Colver of Toronto.

Strathroy, Ont.—The Union Gas Co. will drill a number of wells in this district.

Regina, Sask.—A company is being organized to establish a plant for making steel culverts.

Sherbrooke, Que.—A new plant will be established here by a Mr. Ashenhurst of Chicago for making asbestos products.

Niagara Falls, Ont.—The Hydro-Electric Commission are now making headway with the work of drilling test holes for a proposed canal from Chippawa to the Whirlpool.

Chatham, Ont.—The plant of the Canadian Wolverine Co. was destroyed by fire on April 10. The loss is estimated at $125,000 and is covered by insurance up to 80 per cent.

Saskatoon, Sask.—The Canada West Grain Co., whose headquarters are in Melfort, are making arrangements to increase their elevators from eight to ten, possibly eleven.

Toronto, Ont.—The large brick factory lately owned by the Novi-Modi Costume Co., now in liquidation, has been sold to Cutten & Foster, manufacturers of automobile and boat supplies.

St. John's, Nfld.—Announcement is made of the registration by Thomas Leopold Wilson, of Ottawa, of a company with a capital of $2,000,000, formed to develop electrical energy for the manufacture of fertilizers in this colony.

Sedgwick, Alta.—The Alberta Farmers' Co-operative elevator was burned to the ground here on April 10. The elevator was built by the Farmers' Co-operative Elevator Co., of Sedgwick, Ltd., at a cost of about $8,000. Both building and grain were covered by insurance.

Toronto, Ont.—The Corn Products Refining Co., a United States corporation capitalized at $8,000,000, has completed plans for opening a plant in Ontario. The proposed plant will use about 10,000 bushels of grain in a day. It is probable that the plant will be located here or in Hamilton.

New Incorporations

The Dominion Bridge Co., Montreal, has had the charter extended to cover the manufacture of projectiles, guns and armoured cars, etc.

The Diebel Furniture Co. has been incorporated at Ottawa, Ont., with a capital of $50,000 to manufacture furniture at Stratford, Ont. Incorporators: C. Diebel, E. Diebel and E. E. Diebel, all of Hanover, Ont.

The Sarnia Metal Products Co. has been incorporated at Ottawa, Ont., with a capital of $100,000 to manufacture sheet metal products at Sarnia, Ont. Incorporators: Lloyd Lott, A. MacD. Lott and J. Garroch, all of Sarnia, Ont.

The Standard Planing Mills, Ltd., has been incorporated at Toronto, Ont., with a capital of $40,000 to operate planing mills at North Bay. Incorporators: C. W. Wilkinson, S. L. Mulholland and H. G. McDermaid, all of Toronto, Ont.

The Rathbun Match Co. has been incorporated at Ottawa, Ont., with a capital of $125,000 to carry on the business of a match factory at Desoronto, Ont. Incorporators: R. P. Locke, G. Cooper and Wm. Kaspar Fraser, all of Toronto, Ont.

The Franklin Steel Works, Ltd., has been incorporated at Toronto, Ont., with a capital of $40,000 to manufacture toe calks at Hamilton, Ont. Incorporators: William Lees, Thomas Hobson and R. P. McBride, all of Hamilton, Ont.

The Winnipeg Oil Co. has been incorporated at Ottawa, Ont., with a capital of $1,000,000 to refine and deal in petroleum, natural gas, etc., at Winnipeg, Man. Incorporators: W. A. J. Case, C. G. Lynch and W. J. Beattie, all of Toronto, Ont.

The Reid Appliance Co. has been incorporated at Ottawa, Ont., with a capital of $50,000 to manufacture automobiles, motor boats, etc., at Windsor, Ont. Incorporators: T. B. Mothersill, A. R. Bartlet and W. G. Bartlet, all of Windsor, Ont.

The American Nitrogen Co. has been incorporated at Ottawa, Ont., with a capital of $4,000,000 to manufacture nitrogen, nitric acid and other acids at Montreal, Que. Incorporators: G. A. Campbell, F. Langford and Winthrop Brainerd, all of Westmount, Que.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British.—Lieut. Johnston and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

The Kerosene Burning Carburetor Co. has been incorporated at Ottawa, Ont., with a capital of $100,000 to manufacture automobiles, motor cycles, etc., at Berlin, Ont. Incorporators: J. Darcy, C. Forsyth, B. S. Sheldon and O. F. Dannecker, all of Berlin, Ont.

Tenders

Hamilton, Ont.—Tenders will be received up to April 27 for one eight million gallon capacity centrifugal sewage pump and motor. Specifications may be obtained at the office of the city engineer, A. F. Macallum.

Ottawa, Ont.—Tenders will be received by the secretary of the Water Works Committee, Ottawa, up till Wednesday, May 12, 1915, for the supply and erection of one electrically-operated pumping unit. Specifications and full particulars may be obtained on application to the city engineer's office, city hall, Ottawa.

Ottawa, Ont.—Tenders for alterations and addition to Postal Station "A," Toronto, Ont., will be received until Monday, April 26, 1915. Plans, specification and form of contract can be seen and forms of tender obtained at the office of Thos. A. Hastings, clerk of Works, Postal Station "F," Yonge St., Toronto, Ont., and at the Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until Wednesday, May 5th, 1915, for the supplying, manufacturing and erecting wagon and cylindrical valves for certain locks on the Trent Canal. Plans, specifications and forms of tender can be obtained by application to the chief engineer, Department of Railways and Canals, Ottawa, or to superintending engineer of the Trent Canal, Peterborough, Ont.

Ottawa, Ont.—Tenders will be received until Wednesday, May 5th, 1915, for the manufacture and delivery of operating machines, anchorage fittings and pivots for locks, and gains for emergency steel stoplog bridges for the Trent Canal. Plans, specifications and forms of tender can be obtained by application to the chief engineer, Department of Railways and Canals, Ottawa, or to superintending engineer of the Trent Canal, Peterborough, Ont.

Contracts Awarded

London, Ont.—The waterworks supplies for the year will be purchased from the Empire Mfg. Co. of this city.

Montreal, Que.—The following contracts have been awarded by the Board of Control in connection with the new lighting system on St. Catherine and Bleury streets: Lamp standards, G. M. Gest, $6,090; cables, the Eugene F. Phillips Electric Works, $21,211; lamps, the Canadian General Electric Co., $10,-657.

Winnipeg, Man.—The contract for the construction of a steel and concrete bridge over the first crossing of the Nelson River on the Hudson Bay Railway has been awarded to the Canadian Bridge Co., of Walkerville, Ont. The bridge will be 500 feet long, with a main span of 305 feet. The cost will be about $175,000.

Building Notes

Toronto, Ont.—The C. P. R. will build a new station at North Toronto. Darling & Pearson, of Toronto, are the architects.

Victoria, B.C.—A permit has been issued to T. R. Cusack for a warehouse to cost $5,000. C. E. Watkins is the architect.

Georgetown, Ont.—The general contract for the erection of a transformer station here for the Toronto Suburban Railway Co., has been let to Wells & Gray, Toronto.

Halifax, N.S.—Immediate construction of an academy building at a cost of $30,000, to replace the one recently destroyed by fire, has been decided upon by the Board of Governors of Acadia University, Wolfville.

Toronto, Ont.—Plans submitted by R. C. Bustard to the City Architect's Department for a six-storey store and office building on the east side of Yonge Street, near Isabella, have been approved. The building is to cost $29,000 and will be a brick and terra cotta structure.

Toronto, Ont.—The City Architect's Department issued a building permit to the Board of Education for the erection of the new Administration Building on College street, near the old Technical School. The new structure, which is to cost $100,000, will be built of brick and steel and will be four storeys in height.

London, Ont.—At a special meeting of the Board of Education, held recently, the following architects were selected: It was decided to give the North-End School to Watt & Blackwell and W. G. Murray; the Princess Avenue School to McBride & Gilbert and A. E. Nutter, and the Riverview and West London Schools to Messrs. John M. Moore, J. Vicar Munro and L. E. Carrothers. The first job will be worth $55,000, the second $70,000, and the third $55,000.

Personal

John S. Anthes, one of the oldest and best known furniture manufacturers in Ontario, died at Berlin, Ont., on April 13, in his 71st year.

E. R. Gray of the Toronto Works Department, has been recommended by the Hamilton Board of Control as assistant city engineer in that city.

Ralph Hewson, assistant engineer, Toronto Harbor Commissioners, has left for St. John, N.B., to join the Canadian Pacific Overseas Construction Corps, which leaves for France early next month.

Andrew Joseph Wilson, for 18 years manager of the Linde Canadian Refrigeration Co., died at his home, 78 St. Alban street, Toronto, on April 18. The late Mr. Wilson was born at Gaspe, N.B., and came to Toronto in 1895. He was 39 years old, and retired from the above company about 3 years ago.

Lieut.-Col. Lacey Johnson, who was recently appointed general welfare agent of the Canadian Pacific Railway, died on April 17 of peritonitis, after three weeks' illness. He was born at Abington, Berkshire, England, and was in his sixtieth year. Lieut.-Col. Johnson, at the time of his appointment to the position of general welfare agent of the C. P. R.,. was general superintendent of the Angus shops, and had been connected with the C. P. R. since 1882.

Refrigeration

Regina, Sask.—The city council are considering the advisability of establishing a municipal abattoir and chilling plant. The city commissioners have been instructed to prepare an estimate of the cost.

Tillsonburg, Ont.—The Borden Company are preparing to build an extension to their plant to be used for cold storage and as a shipping room. The company is contemplating an addition to their factory at Ingersoll and have asked the council of that town for an option on 110 square feet of land owned by the corporation.

Wood-Working

Owen Sound, Ont.—Wm. Pedwell's sawmill was destroyed by fire on April 17. The loss is estimated at $10,000.

Halifax, N.S.—The Piercy Supply Co. propose to re-open their factory and woodworking plant if they can obtain concessions from the city.

Railways—Bridges

Edmonton, Alta.—The Government resolution providing for a guarantee of the branch line of the Edmonton, Dunvegan and British Columbia Railway from a point on the main line south to Grande Prairie, a distance not exceeding 60 miles, at $20,000 per mile, passed in the Legislature on April 14 by a vote of 30 to 16.

Transcona, Man.—W. J. Christie, of the firm of W. J. Christie & Co., Union Bank building, Winnipeg, proposes to build a street car line from the corner of Oxford and Regent, Transcona, to the western limits of the town, to connect with the Winnipeg street car on Talbot avenue, Elmwood.

Marine

The storm signal service was resumed on all of the lakes on April 16, and will be continued until the close of navigation.

Amherstburg, Ont.—Under a new ruling of the Canadian Department of Marine and Fisheries, Canadian fishing tugs on Lake Erie are being numbered and the names of fishing firms are being placed on buoys marking the territory of each to facilitate supervision by Government patrol boats.

Quebec, Que.—G. T. Davie & Sons, Levis, have secured a contract from the United States Government for the construction of twenty motor boats, each of which is to be seventy-five feet in length. The boats will be constructed in the company's yards at Lauzon.

Montreal-Longueuil Ferry.—The new steamer Louis Philippe, specially built for the Longueuil service by the Canada Steamship Lines, is to be placed on the route shortly after the opening of navigation, replacing the steamer Longueuil. It is expected that the new steamer will materially shorten the time between Longueuil and Montreal, and will prove a boon to the Longueuil public.

"Scottish Hero" a Coaster.—The Scottish Hero, the largest of the turret class on the upper lakes, has gone to Ashtabula, where she will be cut in two and towed to the coast, to operate on a three-year charter. It is just ten years since she arrived on the upper lakes, having been brought out from England, cut in two at Levis and towed to Buffalo, where she was riveted up again, and has plied on the upper lakes continuously since.

New Canadian Train Ferry.—A new ice-breaking train ferry for the Strait of Canso service, between the Nova Scotia mainland and Cape Breton, was launched on the Tyne on April 13 from the Armstrong, Whitworth Co. yards. Lady Drummond, of Montreal, in christening the vessel Scotia II., made a happy speech. Ships were always referred to by the feminine pronoun, she said, and this was a compliment to the sex, as ships played an important part in linking and consolidating the Empire. The women of the Dominion which the

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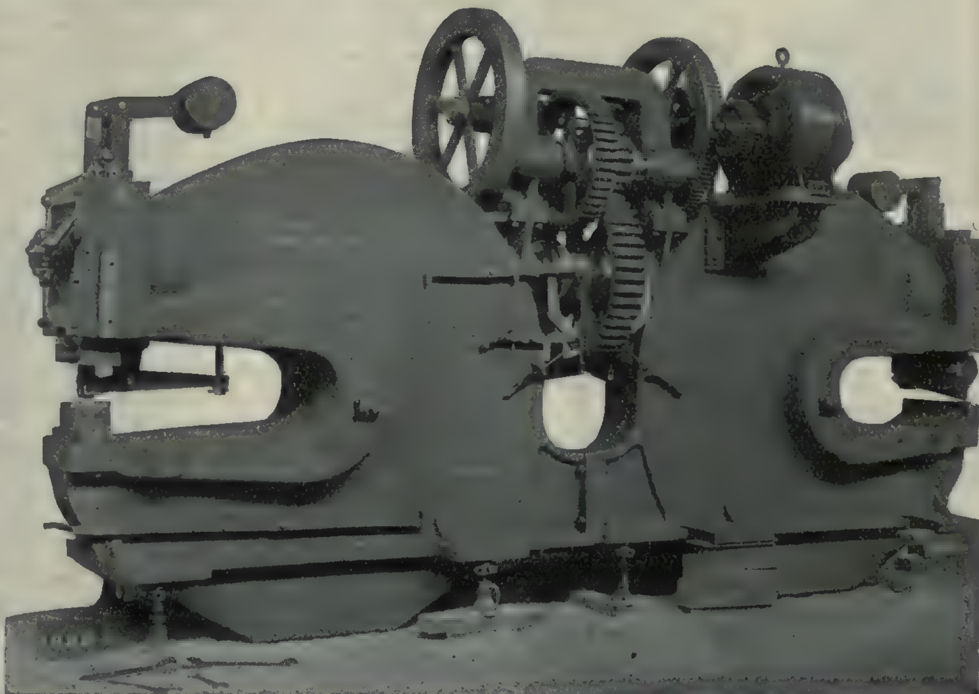

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vessel was to serve were in like manner doing their part in serving the interests of the Empire. The Scotia is 300 feet long over all, 20 feet in depth molded, and having a draft of 14 feet. She is of 3,850 tons displacement. Her contract speed is 10¼ knots, and she has double sets of triple expansion engines.

Trade Gossip

The A. R. Williams Machinery Co., Toronto, have sold to the Board of Education for the new Technical School, Toronto, a number of tools, including a die sinker, grinder, shaper, stamping press and milling machines.

The Sarnia Metal Products Co., Ltd., have appointed George W. Britnell, vice-president of the Toronto Builders' Exchange, as their sales manager, with office in the Builders' Exchange, 154 Simcoe Street, Toronto.

Toronto Harbor Improvements.—The Harbor Board have notified the Board of Control that they wish to commence the reclamation of park lands on the Island and on the western waterfront at a cost of $407,862, the interest of which, amounting to $24,471, will have to be met by the city. For the season the Harbor Board propose to reclaim, by dredging, a certain amount of land lying to the east and west of Ward's Island for the purpose of furnishing additional camping ground. This will entail the pumping of 103,508 cubic yards of material. Immediately west of Ward's Island another area is to be reclaimed, and to get the proper elevation 654,013 cubic yards of material will have to be pumped.

Catalogues

Coal Drier.—Bulletin No. 212, issued by the Link Belt Co., Philadelphia, Pa., describes the "Wendell" centrifugal coal drier, which is an automatic machine for drying washed coal for coking purposes. A description is given of the machine and the illustrations show the general construction.

The Walcott & Wood Machine Tool Co., Jackson, Mich., have sent us a series of seven leaflets dealing with the Walcott lathes and high-duty crank shapers. The principal dimensions are given for each tool and the features of special value embodied in the design are fully described. The illustrations give a general idea of the design and construction of both the shapers and engine lathes.

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, have just issued a booklet entitled "About Hydraulic Presses and Pumps." This booklet, which has been prepared as a souvenir of the company's exhibit at the Panama-Pacific Exhibition at San Francisco, reviews in a comprehensive manner the growth and scope of the organization. Other matter includes descriptions of a few representative designs of presses and pumps, all illustrated, and a list of catalogues which are ready for distribution. The booklet contains 16 pages and is gotten up in attractive style.

Precision Lathes, made by the Hardinge Bros., Inc., Chicago, Ill., are fully described in a catalogue recently to hand. The catalogue deals chiefly with the "Cataract" quick-change swing precision lathe, but a vertical bench miller is also described. A full description with general dimensions is given of the lathe and the principal features are dealt with in detail. The various types of bench lathes are described with price list for the different attachments. The halftones are exceptionally good and show clearly the general design and construction.

Electric Arc Welding.—Bulletin No. 48,904, just off the press, has been issued by the Canadian General Electric Co., Toronto. The bulletin deals briefly with three processes of welding by means of electricity, which is followed by a full description of a general process of electric arc welding, covering the principal features in its operation. Full particulars are given of the welding equipment and its application to various forms of service. A number of illustrations are included showing different classes of work done by electric arc welding. Copies of this bulletin can be obtained on application.

AIRCRAFT IN WARFARE.*

ROUGHLY speaking, there are only two descriptions of air-craft in military use, those which are heavier than air and which depend for sustentation entirely upon aero-dynamic reaction, and those which are sustained in mid-air by containing a gas which is lighter than air itself. The kite and the aeroplane and seaplane belong to the first category, the balloon and the dirigible to the second. In order to make progress through the air, propellers or air-screws have to be used for traction or propulsion, in conjunction with vertical directing planes or rudders and horizontal or balancing planes for equilibrium.

Kites.

Kites, by far the most ancient of aerial machines, are employed in strings or groups to carry aloft a single observer in a basket car, and the spherical balloon or kite-balloon will carry more than one. In either case the movement of the tethered machine is apt to be disturbing to the vision of the observer, but they can be moved about and lowered or allowed to ascend, being attached to wheeled vehicles provided for the purpose and often do good service. The power-driven kite or aeroplane, and the airship or dirigible balloon of cylindrical or pisciform shape, in addition to affording an elevated platform, enable the observer to accomplish horizontal movements.

The object of using mobile aircraft is to enable the occupants to travel in three directions—upward, downward and forward above the theatre of war, and examine all that is below them from the overhead or bird's-eye point of view. They are employed at present mainly for reconnaissance or the securing of information by specially trained observers, but they are also incidentally available for aggressive purposes. The seaplane, in addition to being a flying machine, can also travel on the surface of the water by means of its propeller, and the floats which it carries under the body in lieu of the wheels on which the aeroplane runs along the ground to get impetus before rising into the air.

Aeroplanes and Monoplanes.

Of the two classes of aeroplane, the monoplane, with its single supporting surface, is, other things being equal, speedier than the biplane with its two super-imposed supporting planes, but the latter is steadier, and the pilot's and the observer's seats can be arranged so as to afford a better view of the ground beneath.

Airships.

Airships are usually termed rigid, semi-rigid, or non-rigid. The first type, to which the well-known Zeppelin dirigible belongs, has a stiff framework of wood or aluminum alloys, divided longitudinally into compartments, each containing a separate balloon or gas-holder. The whole framework is covered with waterproof material to give a smooth outer surface and preserve the balance from the effects of sun and rain, both of which have a very deteriorating effect on the fabric of the envelopes. The cars, containing engines, crew and observers, are connected to the underside of the framework, and there is an enclosed gallery for communication between the cars. The propellers are carried on projecting brackets at either side of the cylindrical body, and the horizontal and vertical planes and rudder at the stern; both bow and stern are bluntly pointed. This type can be constructed with a platform on the top of the cylinder, to carry observers and machine-guns, and connected with the gallery by a well-ladder; but owing to the liability of ig-

*From a paper read by Major H. Bannerman-Phillips before the North-East Coast Institution of Engineers and Shipbuilders.

nition of the mixture of gas and air caused by leakage of the balloons, it is doubtful whether firearms could safely be used on this platform.

In semi-rigid airships the envelope is flexible. The weight of the single car is distributed over the length of the envelope by means of an intermediate girder of metal tubing. The envelope keeps its shape by reason of the gas pressure within. In non-rigid airships, the car is suspended directly from a flexible envelope without the intervention of a girder. The rigid airship has, so far, been the speedier of the three types.

In the case of non-rigid dirigibles, such as the Parseval, in order to keep up the internal pressure and maintain the shape of the envelope in case of loss of gas, there are flexible airbags or ballonets inside the gas-container, which at starting can be left empty and lie flat, but can be pumped full of air by a separate tube to fill up the cubic space of the container, which has become void during a journey.

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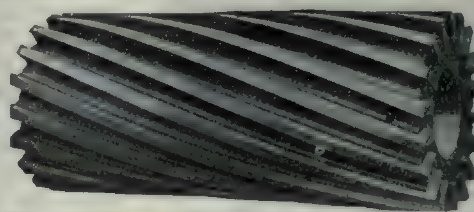

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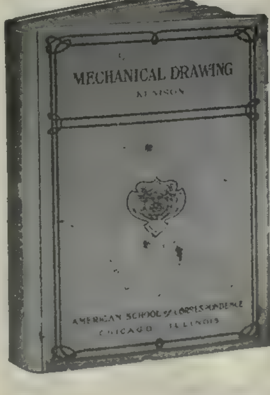

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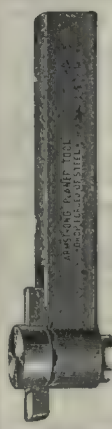

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TOWARDS the middle of last year, Canada, in common with the United States, and, to a certain extent, other countries, was experiencing the reaction due to a long period of prosperity, with its consequent extravagances and more or less wild financial speculation. One after another, factories began to lay off men, work short time, and even to shut down. Then in August, like the fates, came the European war to change a condition of tight money and business depression into one of apparent hopelessness.

A more or less panicky situation developed, arising largely from the feeling of uncertainty as to our Empire's preparedness to protect its widespread territory, to maintain the freedom of the seas, to stem the progress of Germany's military machine, and help put a crimp in her long-time-cherished, all-conquering, but otherwise insane ambitions.

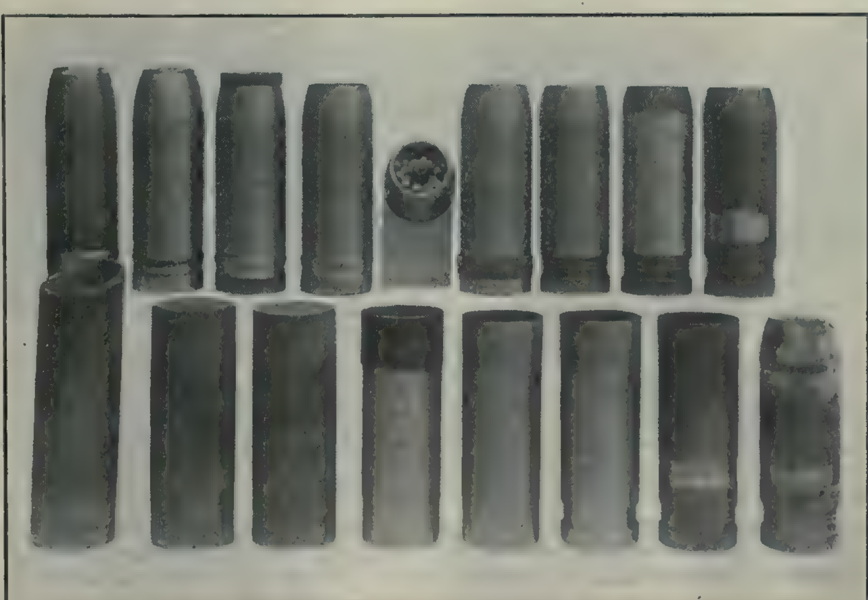
It was early noted, however, that, whatever the position from the land or strictly military viewpoint, with regard to sea power and sea control, "Britain ruled the Waves," and that although some little time must elapse before the various enemy raiders known to be afloat were driven to neutral ports or "Davy Jones Locker," trade and commerce would suffer otherwise little interruption. Intimation that the rush on Paris by the Huns had been permanently stemmed soon followed and served as it were to complete the assurance that the crisis had passed and that for industrial Canada the future motto would be that of capturing the enemy's trade. Broadcast publicity in the latter direction followed, but whether "what is everybody's business is nobody's business," or otherwise, results were nil, or at best disappointing.

Capturing Enemy Trade.

In this respect Canada was no more guilty of what might be termed a sin of omission than the Old Land or than the United States, and this leads us to remark that, after all, the slogan "capture the enemy's trade," was to a large extent but an expression of our indignation at their procedure, and smacked of school boy action and retaliation. Superlative effort to capture at one swoop enemy trade abroad may be classed in the impossibility category so far as results are concerned, and business men began to realize this even before the warmth of their enthusiasm so kindled had wholly cooled. They realized that doors of opportunity were open which hitherto had not appealed to them with the like insistence and forcefulness but they further appreciated the fact that the work must needs be one of more or less nursed development. To this end our manufacturers are now applying themselves, and the achievement recorded in the brief space of a few months is satisfactory evidence that if enemy trade is not being captured, it is at least being systematically acquired.

Reference has already been made to our Empire preparedness for war and more particularly war on the gigantic scale on which that now raging is being waged. Our fleet, the men who designed, built, manned, operated and directed it, had been, were and are easily equal to every contingency, humanly speaking, likely to arise. In matters military the position was and has always been different. The maintenance of a standing army running into millions of men of all ranks and services had neither been found desirable nor necessary. In like manner, war munitions were not on tap on a stupendous scale.

To meet the unique military situation created by an all-European war the call was made for both men and munitions in number and quantity easily and altogether unprecedented in our Empire history. The munitions of war being the feature with which we are at present dealing more particularly, it is sufficient to remark here that as regards the call for men, the British Isles have done themselves proudly, and, we in Canada, have not only made noble response, but as recent

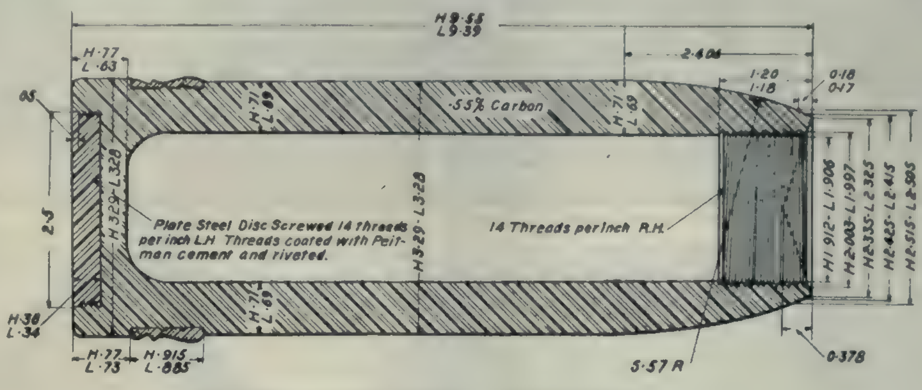


SHELLS IN PROCESS FROM THE FORGING TO THE PRODUCT AS COMPLETED IN CANADA.

reports from the front only too plainly indicate, we, through our representatives there, are earning undying fame, the admiration of our friends, and have instilled into the hearts of our enemies the knowledge that we both know and are attending to our business, of whatever its nature may be at any moment.

Canada's Response.

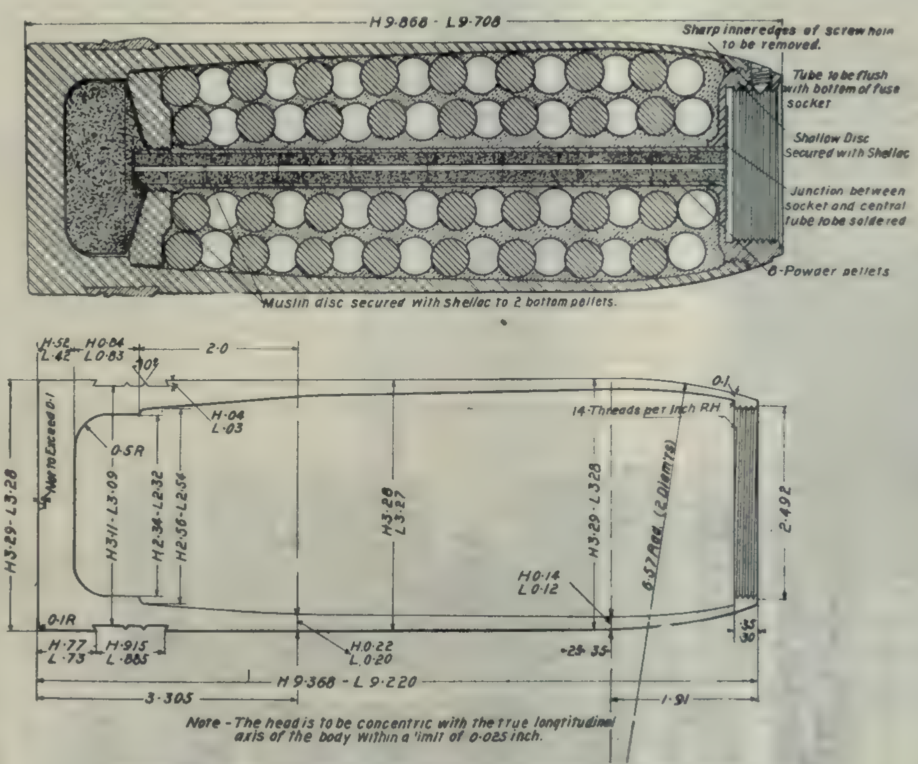
Little did Sir John French realize, when he gave utterance to the for-all-time memorable statement-request, for "shells, and shells, then more shells," in order to prosecute the war to its early and logical end, that Canada would play so important a part in placing these commodities at his disposal.



BRITISH 18-POUNDER HIGH EXPLOSIVE SHELL.

That our metal working industries have risen to the occasion is amply borne out by the peace-time variety-product plants featured in this issue as war-time producers of shrapnel and high exploshells. More or less surprise is, however, being expressed — we should say simulated, rather — that "Canada's Response" has been so universally effective, and not a little credit is being appropriated by our American brethren for the achievement. It is claimed that for the most part we have in the past been devoid of enterprise, and that our manufacturers doted and were prone to converse on sport and recreation in business hours to an extent highly detrimental to the pursuit of commercial ascendancy. In a word, we are reputed to have been conservative, contented and easy going, and the fact that we have broken away from such a condition combination is being attributed to our sudden acquirement of the business energy of our American cousins.

Business and pleasure mate desirably, and either alone becomes nauseating if practiced without intermission. Our manufacturers have realized that, for a period, whole-hearted devotion is meantime necessary to the equipment of their plants and to the establishment of ways and means for smooth running to secure quality and quantity output of shells. They have at the moment no time, it is true, to tell of fishing successes or of the exploits of hunting expeditions, but long before the war is over they will catch many fish, kill many deer, resume their wonted attitude of good fellowship in talking sport and pleasure an,d withal be supplying the Allies from twenty-four-hour-day capacity plants, with shells in number far exceeding present efforts.



CONSTRUCTIONAL FEATURES AND DIMENSIONS OF BRITISH 18-POUNDER SHRAPNEL SHELL.

Of all the crafts represented in the prosecution of the war, that of engineering in its every aspect is dominant, and it is therefore only fair and giving "honor to whom honor is due," to give our metal working plant administrations the fullest degree credit for the native initiative and enterprise which has characterized them at this critical period of our national and Empire history.

GUN ENDURANCE.

IMPORTANT as is the necessity that the Allies have a superabundance of shells of wide variety, sort and size, it is equally so that the gun provision for their effective and accurate discharge be adequate in every respect. Particularly, of course, is this supremely desirable in the matter of continuous bombardment of land forts either by warships or shore batteries on which powerful and long range ordnance are mounted. Discussing the endurance or "life" of guns, having in view those mounted on war vessels and with special reference to the forcing of the Dardanelles, a writer in the Liverpool Journal of Commerce says that it is well known that gun rifling becomes worn down after a certain number of rounds have been fired, and, although the gun can still be used, it is no longer efficient in rotating its projectile.

The maximum number of rounds depends on the size of the gun and on the value of the charge used, the life of the gun being generally expressed by the number of full charges that can be efficiently used. If great penetration is necessary, as for armour piercing, full charges would generally be taken, but with high explosive shells the essential thing is to get the projectile on the ob-

jective, its explosion does the damage. The full powder charges are usually made up in four equal parts, and three-quarter, half, or quarter charges, will be used in accordance with the distance to be covered.

The 15-in. guns on our battleship Queen Elizabeth are capable of firing shells a distance of over twenty miles. The official reports of the Dardanelles firing indicate, however, that nothing like this distance has been found necessary, and it may be taken for granted that full or service charges have rarely, if ever, been used by that vessel, thereby increasing the number of rounds that can be fired. In firing across the Gallipoli peninsula at the inner forts, the maximum ranges did not exceed twelve miles.

Gun Calibre a Factor.

The number of full charges that can be fired increases very rapidly with the calibre of the gun. The nominal figure for the British 12-in. gun is given as eighty, but twice this number can be used with effect. In the 13.5-in. 45-calibre gun, 450 rounds are possible. The figure for the latest 15-in. guns have not been published, but the number can safely be taken as being considerably in excess of that for the 13.-in. gun.

The reason for this great increase in endurance is not far to seek. High muzzle velocity is most effective in wearing down the rifling, and in the larger guns this has actually been reduced. The muzzle energy has, however, been increased by adding considerably to the weight of the projectile. The heavier shell also possesses a great advantage in carrying an explosive charge very much larger than that for the smaller gun.

Re-tubing.

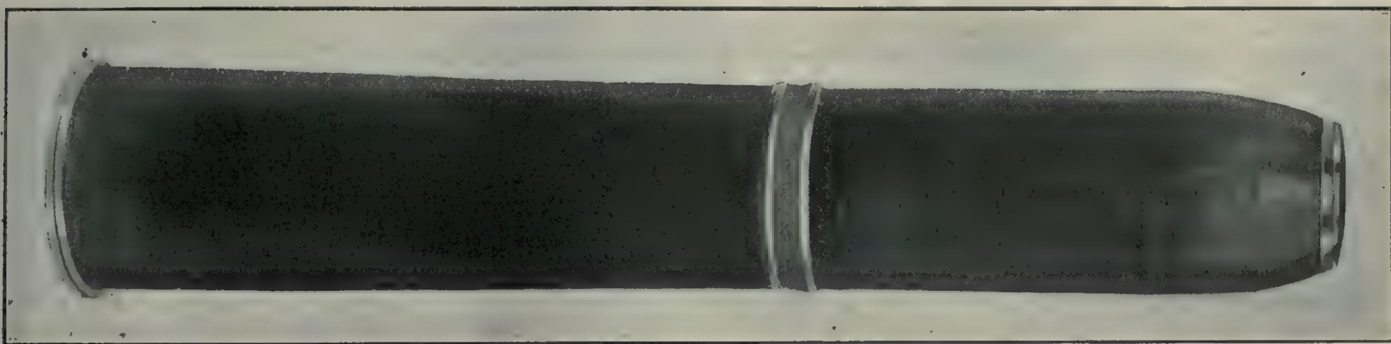
When the rifling is worn out, the gun must be re-tubed, an operation which can only be performed at a dockyard or naval base. It will be readily seen that the staying power of the Queen Elizabeth in this direction must be of immense value in the present operations, and it is not improbable that other vessels with modern guns will be brought into action against the forts at the Dardanelles.

The First Lord of the Admiralty, speaking in March of last year with reference to the 15-in. guns, said "the whole of the 15-in. guns for the ships of the Queen Elizabeth class were ordered without ever making a trial gun. They reproduce all the virtues of the 15.5-in. gun on a larger scale, and as it is never pressed to its full compass by explosive discharge, it will be an exceptionally long-lived gun." These predictions have been abundantly fulfilled. and give a further justification of the big-gun ship.

Big Gun Preponderance.

The large number of big naval guns available at the Dardanelles is surprising in view of the presence of numerous warships in other places, and is a striking tribute to the naval power of the Allies. Taking the vessels that have been mentioned officially, it appears that the following big guns have been or can be put in operation against the forts:

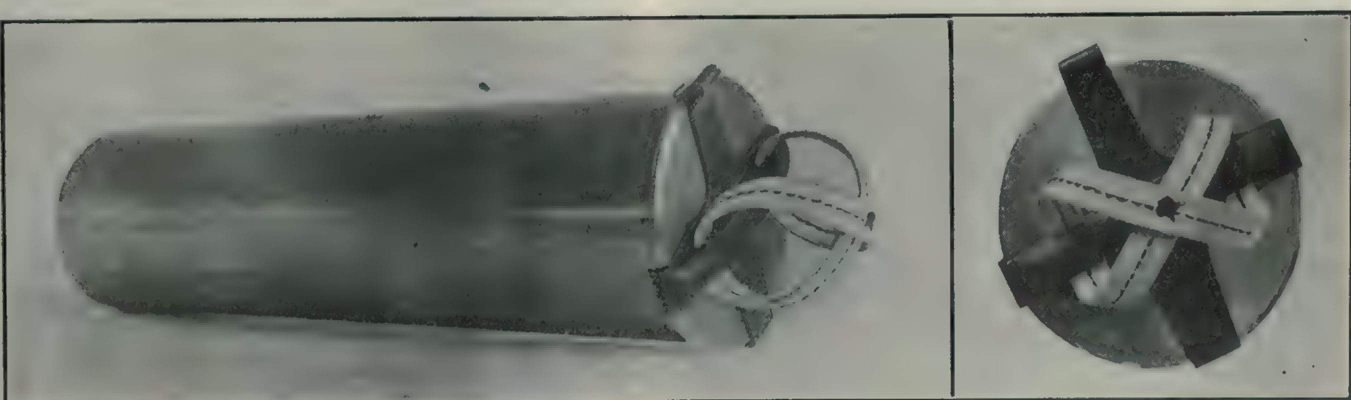
Eight 15-in., sixty-two 12-in., four 10.8-in., eight 10-in., twenty-four 9.2-in., and twenty-eight 7.5 in., making a formidable total of 134. How many of these guns have been pressed to their full capacity it is impossible to say, but the need for renewal facilities is apparent. Malta Dockyard is a tremendous asset to the Allies in this direction alone, apart from the numerous other functions it fulfils. In any case the renewal of the naval guns is a much easier matter than that of the weapons on the land forts, a fact which will hasten on the inevitable result.



CANADIAN-MADE 18-POUNDER SHRAPNEL SHELL AND CARTRIDGE CASE.

LESSONS FROM THE SHELL PROBLEM.

A STUDY of shell manufacture as it is being carried on in Canada at the present time reveals at least three different general systems being employed. These may be stated as follows:—First, the full automatic method; second, the standard machine tool plan, with grinder finish; and third, the standard machine tool method with machine finish. The first system is applicable only to institutions that are willing to make a considerable investment in special machinery. This consists of grinders, automatic milling machines, furnaces, etc.



CARTRIDGE CASE WITH DRAWING CLIP ATTACHED.
This clip is one of the incidentals being made in Canada for the British Government and forms an interesting job of blanking, piercing and drawing.

Uncertainty as to the duration of the war and the ultimate quantity of shells required are factors that must necessarily be considered when determining any particular system. The prices obtained for the work being fixed, and the market for the duration of the war practically unlimited, there is offered very great advantages by the automatic system of manufacture if the investor obtain orders enough to ensure at least the return of the capital invested. In several cases the adoption of the full automatic method has been made feasible by the fact that the special machinery purchased for shell manufacture can be readily assimilated into the general system of the plant at the close of the war.

The factories of Ontario and the Eastern Provinces generally have in the past been slow to adopt the latest types of machinery for their regular work so that the preparation for the shell business is likely to eventually result in putting machinery manufacture in Canada upon a more up-to-date and better paying basis. The system of producing shells adopted by the greater number of Canadian factories is that involving the use of standard machine tools along with the addition of special grinders, etc.

An Interchangeable System.

Much credit is due the various managements for the manner in which they have met the need for special machines and appliances demanded, and so complete has been the organization of the business by the Shell Committee that arrangements can be made for any plant to do whatever part of the whole work comes within its capacity. A number of plants are turning out shells with a tool finish, but many are adopting the grinding method as this is being more fully developed to meet the special need. Without doubt, the most useful adjunct to any plant undertaking this shell production work is a good mechanical schemer to devise ways and means. Shell making belongs properly to the interchangeable manufacturing system and a plant designed for doing this work and nothing else would have a tremendous advantage over the converted plant, but this advantage can be greatly lessened for the jobbing shop by a resourceful mechanical head. The small plant, in making investments in new machinery is advised by the better authorities to buy heavy standard machines such as will be of most use when the war is over and the needs of peaceful trade begin again to demand attention. The greatest mistake that has been made so far even by firms whose capital investments have been considerable, consists in the purchase of too light machine tools, particularly in the matter of grinders and milling machines.

General Impressions.

For the first operation of cutting off the open end of the rough forging, everything from bolt cutters to Gisholt lathes are being used. A most practical and successful arrangement seems to be that using two cut-off tools feeding towards each other and operated by a right and left hand screw. This may form part of the regular cutting-off machine, but has been successfully applied to lathes and pipe machines. By applying a power feed mechanism, one man can easily handle several machines.

For the facing of the bases also, a number of creditable devices are employed. There seems to be no doubt, however, as to the ascendency of the milling machine which is powerful enough to work large high speed facing cutters to their capacity, and in which the process is practically continuous. Machines of this kind have handled as high as 1,200 shells per day of 20 hours.

Heat Treatment.

The rough turning of the body has perhaps been subject to the greatest variety of ways and means, and the result of an extended observation seems to favor the heavy turret lathe for this work. The forging is best held on and driven by a solid arbor securely fastened to the face plate of the machine. Otherwise, if a centre is used, it interferes with the facing of the end, and, if a driving dog is used, the shell cannot be turned for nosing at the same setting. The use of multiple tools as adopted in the low-swing lathe has been more or less discouraged by the lack of uniformity of the shell case material, many having tried this, and have gone back to the single tool that can be quickly replaced when dull or injured.

An interesting method of grinding has been developed in this connection. Tool bits are made in sets of 16, and all are ground exactly the same, particularly as to length. The mechanic can thus dull 16 tools without changing the adjustment of his machine, and when the set is dull, all the tools are finish ground at a single setting of the grinding machine. Multiple tooling in which the tools operate on opposite sides of the work, thus neutralizing the lifting strain on the arbor has been found quite satisfactory in several plants and has resulted in an increase of production. For the boring also the heavy turret lathe is undoubtedly popular, although the multiple spindle machine has not come up to expectations.

Of the many types of cutter employed, the flat, formed, high speed steel bit that can be quickly removed and replaced has been well proven. High speed steel twisted drills which have been ground to a suitable form are conceded to do good work but are complained of as being bulky and expensive. Multiple spindles are of advantage where the tools can be operated independently.

For heat treatment, the different makers have been left largely to their own resources with the result that many widely different plans have been adopted. The most striking feature in connection with this is the elaborate nature of some equipments while others are accomplishing satisfactory results with a much simpler and less expensive outfit. This applies particularly to the annealing.

Where sand blasting is available, all that is necessary is to prevent undue oxidation, otherwise the base and groove must be treated before heating with something that will not only prevent oxidation, but which will facilitate cleaning as well. Boracic acid has been successfully employed for this purpose, the shells being washed in water as soon as possible after chilling. Nosing seems to present few difficulties, everything from bulldozers to converted stamping presses being employed with success. The vertical, quick acting machine, however, has decided advantages.

For turning the nose inside and out, the ordinary diamond point tool guided by a profile cam appears to be the most successful. Formed tools are used to a considerable extent, but there seems to be no advantage in point of output over the regular turning tool and cam. Another advantage with the cam method is that very light machines can be used, whereas a formed cutter of these dimensions would demand a powerful lathe. The tapping is apparently most satisfactorily done on a machine by itself, using a collapsible floating tap.

Assembling.

The assembling involves a large number of small operations and a great deal is to be gained by a systematic arrangement. Many firms have gone to some pains to heat the bullets, while others claim this precaution to be unnecessary; an examination of the rosin at its most liquid temperature would seem to bear this out. If this heat be maintained and the rosin run in quickly no trouble should be experienced with poor fluxing. Screwing in of the sockets is done by hand with plug drivers and wrenches. Some plants are using ball bearing plugs, while others declare these to be a failure and are using solid plugs instead. One or two firms are building machines for this, as well as to fill the shells with the exact number of bullets.

Finishing the socket is best done with a flat formed cutter which can be ground without altering its form, but this should be set up along with another tool for finishing the inside so that neither will have to be changed throughout the operation. Circular forming tools have not proved an unqualified success either in this or turning the band.

Shrapnel Shell Manufacture

Shell Department of a Stationary Steam Engine Works

Staff Article

In this particular plant, shell forging from the bar and billet is an additional feature to the machining and otherwise completion processes required of Canadian manufacturers of shrapnel shells, and, as would naturally be expected of a firm whose particular specialty has been and is still high-class steam engine work, there is evident the same studious regard to the exactions of shell production as has characterized their achievement in the other sphere.

THE methods of accomplishing the various operations necessary in finishing an 18-pounder shell call for a rather extensive list of gauges, tools, jigs and fixtures, even when the work is done on machines designed particularly for the purpose. However, when a shop does not purchase new equipment extensively, but adapts its standard machines by the addition of special tools and jigs, the result is that some remarkably ingenious devices are developed.

The plant here described and illustrated has adopted this policy for two reasons. Firstly, because the character of the work was entirely new and it was deemed wiser to accept only a small order to begin with as an experiment. The second reason was the inability of machine tool manufacturers to give early delivery of shell-making tools.

Every available engine lathe was therefore pressed into service. As new machines were delivered and the demand for shells showed no abatement, the standard lathes were still utilized. From time to time improvements in the various attachments were made and operators in the meantime had become very expert. It was thought then to be hardly profitable to throw out all the old machines and replace them with new ones of only slightly better efficiency, especially as the shell demand will automatically cease at the end of the war.

Forging 18-Pr. Shell Blanks.

This shop has been so successful in its machine shop work that the forging of the shells was undertaken in their boiler shop, on a regular type hydraulic press used ordinarily in boiler work. Special dies were made in the tool-room of the shop. In this department, too, excellent results were obtained. Later, three R. D. Wood hydraulic presses were installed expressly for the work.

The steel used to make the shells is from 3½ in x 9 ft. round bar high carbon machinery steel, and the bars are sawn into billets, each about 4½ in. long. Four 24-in. Newton inserted tooth cold saws operate constantly on their production. The saws are driven by individual motors, as will be seen by referring to Fig. B, while the clamps are operated by compressed air. A neat arrangement for handling the bars is part of the equipment of each saw. The bars are carried to the saws by an overhead electric travelling crane and are placed on racks which are built with a slight incline. A bar is allowed to roll off the rack by gravity into the saw carriage.

Provision is made to insure that the bar is moved ahead the proper distance each time a new cut is taken. The bar itself is moved by means of a hand-wheel which traverses the carriage, through the medium of a rack and pinion. A steel rod is attached to a casting fix-

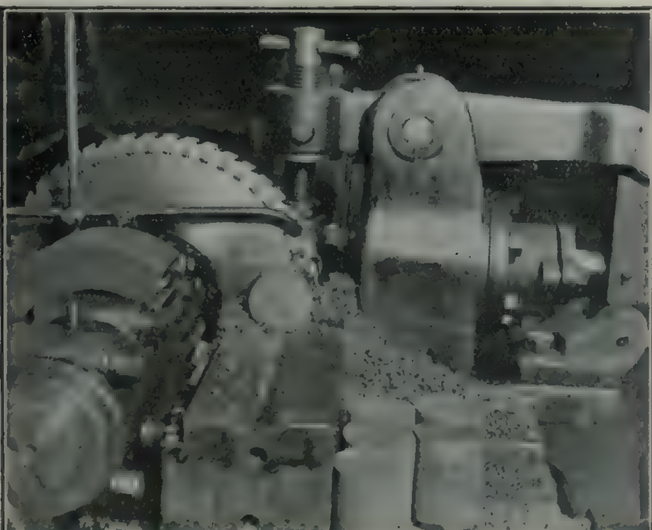


FIG. A—NEWTON SAW CUTTING SHELL BILLETS FROM THE STEEL BAR.

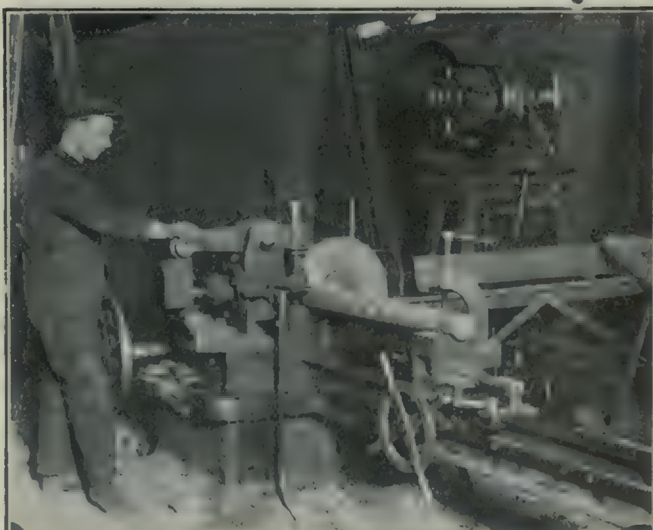


FIG. B—NEWTON SAW SHOWING MOTOR AND STEEL BAR FEED MECHANISM.

ture which can be moved along the bed of the machine and clamped at any position. A part of the saw carriage upon which the bar being cut up into billets is mounted, fits over the steel rod, and the fixture which carries the rod is moved up close to the lug from the carriage and clamped solidly. Thus, at the completion of a cut, the saw is withdrawn and the air clamps released. The bar is then moved up for the next cut.

The projecting lug from the saw carriage follows the steel rod until it comes up against a stop collar on the latter, and when the rod is moved this distance it is in position for a new cut to be made. The clamps are then applied and the saw started in to work again. Meanwhile, the stop casting is unclamped from its position and is moved up till the lug is again against the stop casting where it is again clamped, ready to measure off the next length. It takes one of these saws one minute and thirty-five seconds to cut through the $3\frac{1}{2}$-in. round. Water lubricant is used on the saw.

FIG. E—BELLEVUE ANNEALING FURNACES FOR HEAT TREATING STEEL SHELL FORGINGS IMMEDIATELY THEY LEAVE THE WOOD PRESSES.

The saws have inserted teeth and are giving excellent satisfaction. The time a set of teeth will run without re-grinding varies, but a casual inquiry, however, resulted in the following information being given: A saw was put in commission at noon one day and three days later at 4 p.m. it was still doing good work. Two men keep the four machines running, and the maximum production of one machine per hour throughout the twenty-four hours will be a little over thirty billets.

Heating Billets and Forging.

The furnace used to heat the billets when operations were first started was an ordinary Rockwell plate-heating oil furnace. However, as the plant began to run smoothly, the capacity of this furnace was not sufficiently great to feed the presses, its capacity limiting the output of the forging plant to 1,600 forgings per day. The firm then designed

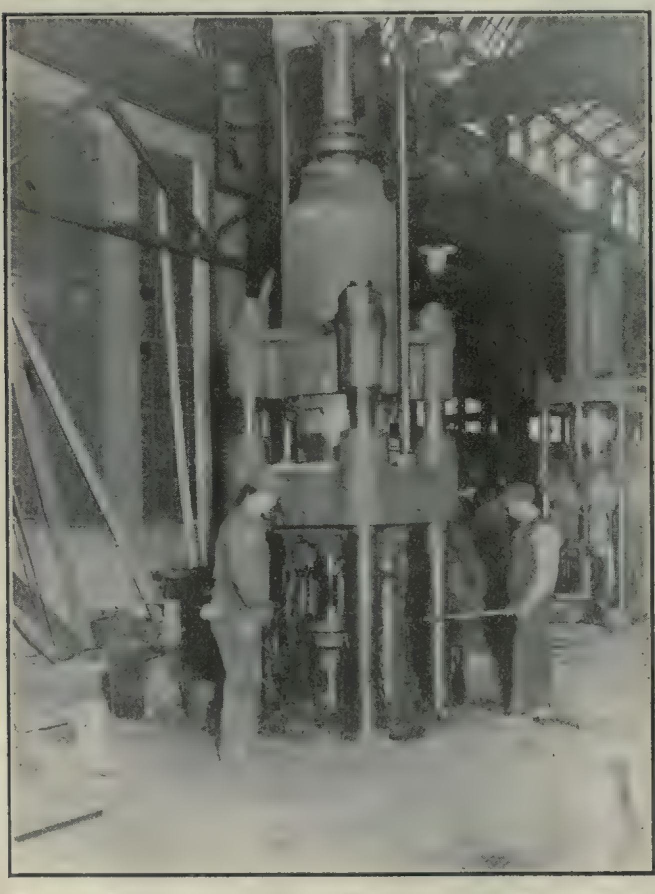


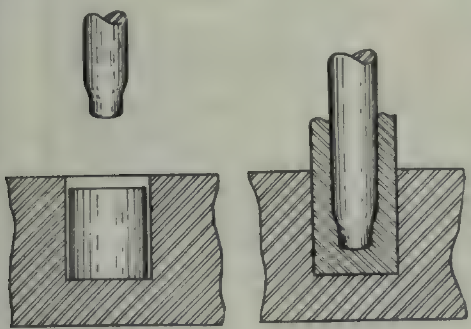
FIG. C—350-TON R. D. WOOD HYDRAULIC PRESS PERFORMING FIRST OPERATION ON 18-POUNDER SHELL FORGINGS.

FIG. D—250-TON R. D. WOOD HYDRAULIC PRESSES PERFORMING SECOND AND FINAL OPERATION ON 18-POUNDER SHELL FORGINGS.

and built a special oil furnace, the muffle of which was constructed on a slight incline. The billets were fed into one end of the furnace and were taken out of the other, the movement of the billets being caused wholly by gravity. The production of the plant is now about 3,000 shells per twenty-four hours.

The billets are heated up to about 2,100 deg. F. and the shell forging is completed in two operations with one heating. The billets are taken from the furnace two at a time by two men. They grasp the billets with tongs and swing them into the dies, knocking the loose scale off in transit by striking the hot billets against a steel block. The punches are well greased with graphite mixed with heavy black oil.

The first or "piercing" operation is performed on a 350-ton, two-punch,



SHELL FORGING—FIRST OPERATION OF PIERCING THE BILLET.

hydraulic press. The billet is pierced and the length of the shell is increased from $4\frac{1}{2}$ inches to roughly 8 inches, as shown in Fig. F. The forgings are taken from the big press immediately to the smaller 250-ton two-punch presses. Here they are placed in a forming die and the punches are allowed to descend. This operation forms the bottom or back end of the shell and makes it the proper size for the drawing die operation, which follows immediately.

The punches are lifted and the forgings are taken up with the punches. The small base-forming dies are removed, the punches again descend, and the forging passes through a series of drawing dies which draw it out to length. It has been found that all these operations can be accomplished with one heating now that the men have become accustomed to the work, and with dies and punches of proper design.

The large press can handle about 150 billets per hour, being its maximum capacity under favorable conditions. The punches in the smaller presses have two operations to accomplish and this not only takes up more time, but heats the punches and dies considerably. Thus, the maximum capacity of these machines is only about half of that of the larger press, or 75 an hour.

The billets after passing through the drawing-out dies are taken from the under side of these and placed in the Bellevue annealing furnaces shown in

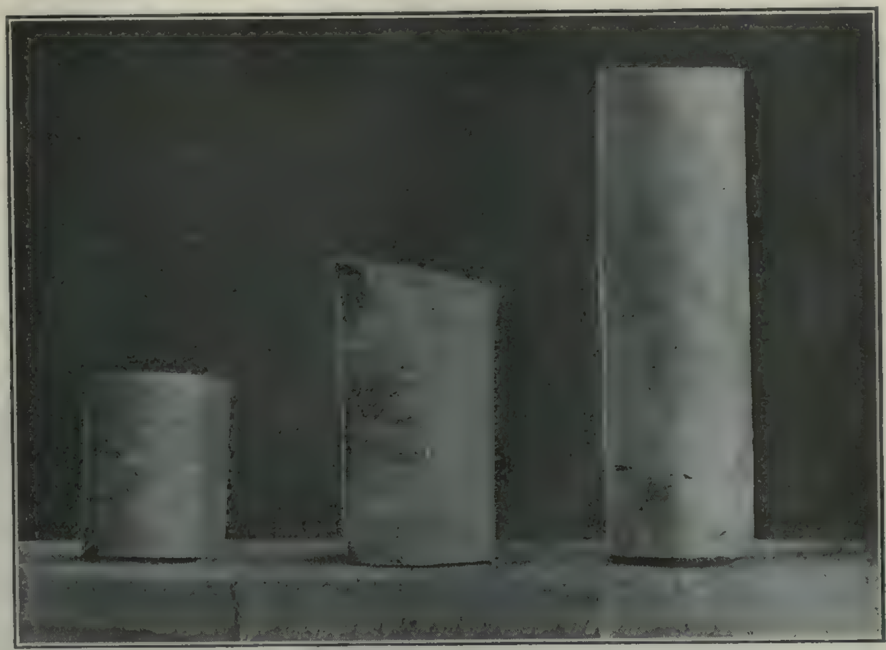
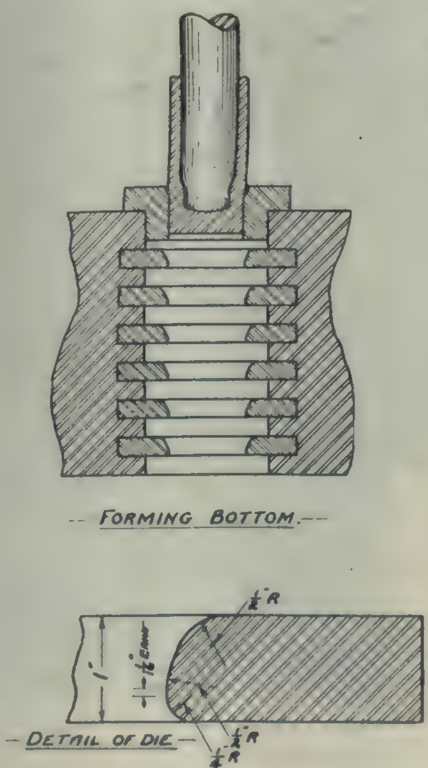
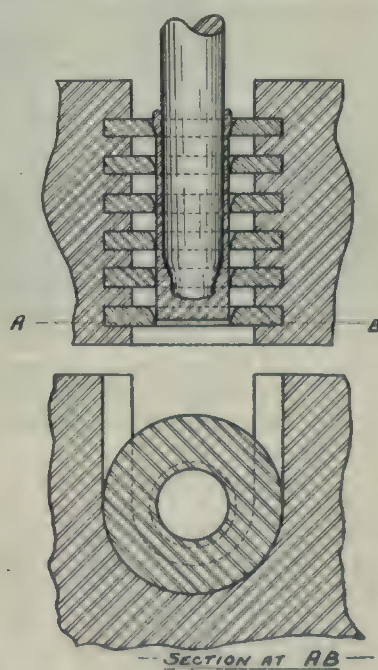


FIG. F—SHOWING STEEL BILLET, SHELL AFTER FIRST OR "PIERCING" OPERATION, AND FINISHED FORGING.

Fig. E. This process is to remove the effects of the chill caused by the comparatively cold dies and punches, and prepare the forging for machining. One





SHELL FORGING—DRAWING-OUT OPERATION IN SECOND PRESS.

reheating Bellevue furnace is placed between the large press and the small presses, and any semi-finished forging which is delayed in the first operation or for any reason appears too cool to go to the second presses, passes through same. A certain number of billets going through the presses at the same time are all placed in one rack and a heat number assigned to them.

The presses are supplied with water at a pressure of 1,500 pounds per square inch from a 100-h.p. Westinghouse motor driven Dean pump, and a Snow steam auxiliary pump is held ready to take up the load should a break-down occur in the motor-driven unit. The production at present approaches three thousand shells per day of twenty-four hours.

Machining 18-Pr. Shrapnel Shells—Cutting Off the Ends.

The rough shell forging is from one to two inches too long, and the first operation in the machining of the shell

FIG. G—ROUGH FINISHING TO LENGTH. BOTH ENDS OF SHELL FORGINGS ON A HAMILTON GEAR & MACHINE CO. CUTTING-OFF MACHINE.

is to cut off the ragged end of the forging. This is done on various types of "cutting-off" machines. A representative type is shown in Fig. 4, Plate I. This is a Hurlbut-Rogers machine, fitted with a three-jaw universal chuck. The shell is pushed into the chuck against the pressure of a coil spring, and a plunger is used to place the shell in the jaws the proper distance. This plunger is bolted to the bed of the machine and is shown in Fig. 21. The link B is fastened with a set-screw on the rod C and the end of the rod is placed in the shell, coming in contact with the bottom.

The shell is pushed in the chuck with the rod C until the projecting arm of the link B can be slipped into the slot A. Then the jaws of the chuck are tightened. The pressure of the coil spring in the chuck tends to keep the shell pressed firmly against the plunger C. Two tools are used in this machine and these are fed into the work by power.

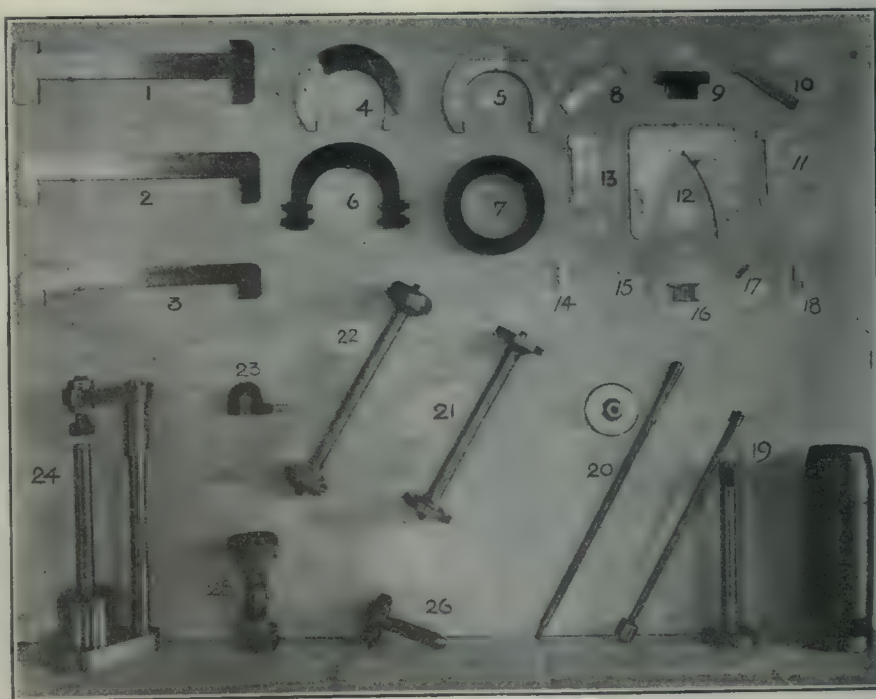
Other types of machines used for this work are as follows: An ordinary Canada Machinery Corporation engine lathe is being used to face off the back or solid end of the shell. The chuck used is shown in Fig. 22. This chuck is supported by a steady rest. The shell is pushed into the chuck against a stop and held there by the tailstock spindle while two set-screws are tightened down. A high-speed steel tool is used to face some 3/8 of an inch to 1/2 an inch of metal off the solid end. The surface (f) having been finished, a little steel distance gauge placed against the finished edge shows the operator when sufficient material has been removed in this rough facing operation.

The machine shown in Fig. G, manufactured by the Hamilton Gear & Machine Co., is one especially designed to cut off both ends of an 18-pr. shell simultaneously. The shell is placed in a chuck with a plunger bar which locates it. The jaws are tightened and the machine started by means of a clutch. The tools are then automatically fed into the work and the shell is cut to rough length and the end faced in one operation. This machine will handle about 20 shells an hour.

All of these machines are connected with the general system of piping through which cutting lubricants are allowed to play freely on the tools. A mixture of lard oil washing soda and water is used on the tools in the operations just described. A second Hurlbut-Rogers friction drive cutting-off machine is also fitted up with a chuck and tools for this work. From these machines the shell goes to the testing bench where it is tested for length and thickness of bottom. The gauge used is shown in Fig. 23.

Rough Turning on Turret Lathes.

Five Jones & Lamson turret lathes are fitted up to accomplish this work. All are hollow spindle machines and each is fitted with a McDougal expanding chuck, the details of which are shown in Fig. 24. A handwheel is fitted to the rod which extends through the hollow lathe spindle. Two sets of three jaws expand and tighten against the inner surface of the shell which is pushed on the chuck until the end of the latter, which acts as a stop, is in



GROUP OF GAUGES AND INSTRUMENTS EMPLOYED IN SHELL MANUFACTURE, AND MADE BY SHELDONS, LTD., GALT, ONT.:

1 Length of finished body without socket. 2—Length overall. 3—Length of body before heading. 4—Diameter for seating for case on rear part of driving rib, high level. 5—Diameter for seating for case on rear part of driving rib, low level. 6—Caliper gauges. 7—Ring gauges. 8—Radius gauge of head. 9—Depth of fuse hole in socket. 10—Form of head before closing. 11—Gauge for nose of shell body. 12—Profile of head. 13—Diameter and angle of recess on socket. 14—Height of band shoulder above base of shell. 15—Depth of thread at head of shell. 16—Width of driving band recess. 17—High and low form of wave rib. 18—Distance of firing screw hole from top of socket. 19—Height of tin cup recess. 20—Depth and diameter of central tube. 21—Seat of disc. 22—Tin cup recess. 23—Thickness of walls. 24—Thickness of finished base. 25—Diameter of screw fuse hole and angle of seat. 26—Screw plug gauge for nose of shell. Some of the above gauges are required in different sizes.

contact with the bottom of the shell. The jaws are caused to expand by the two tapered lengths of the central spindle of the chuck. It will be noted that there is a slight factor of adjustment between these two tapered portions in the shape of a stiff spiral spring. Thus, as the small pair of jaws are designed to seize just before the larger, this spring allows the tapered portion of the spindle to continue to tighten the larger jaws, the spindle between the two sets of jaws meanwhile telescoping slightly to allow this to occur. Flat steel springs withdraw the jaws from the work when the hand wheel is turned so as to release the jaws from the shell.

roughing tool approaches the end of its cut a second tool starts in. This second tool finish turns the shell up about two inches. It is shown in Fig 3, Plate 1. Heavy oil is used as a cutting lubricant on all five of these machines during the operations. When this operation is completed, the turret is swung around and a tool is started to work which refaces the blank end of the shell. This tool works from the near side of the lathe. As soon as the end has been refaced, another tool is fed into the work from the far side of the machine. This tool rounds off the corner of the shell to a curve which has a radius of 1-10 of an inch. This completes the series of end and the recess has been finish-turned in the turret lathe operation just described. There are various methods of machining this groove and likewise many attachments fitted to various types of lathes. In this shop, a rather simple tooling arrangement has been designed and fitted to an ordinary McGregor-Gourlay engine lathe. Figs. 1 and 5, Plate 1, show two views of the lathe so fitted. The waving attachment is shown in the foreground of each cut. On the far side a turret tool post is placed. This lathe is fitted with a special cast-iron hinged chuck, the latter being bolted to the face plate with four cap screws as will be seen in Fig. 5.

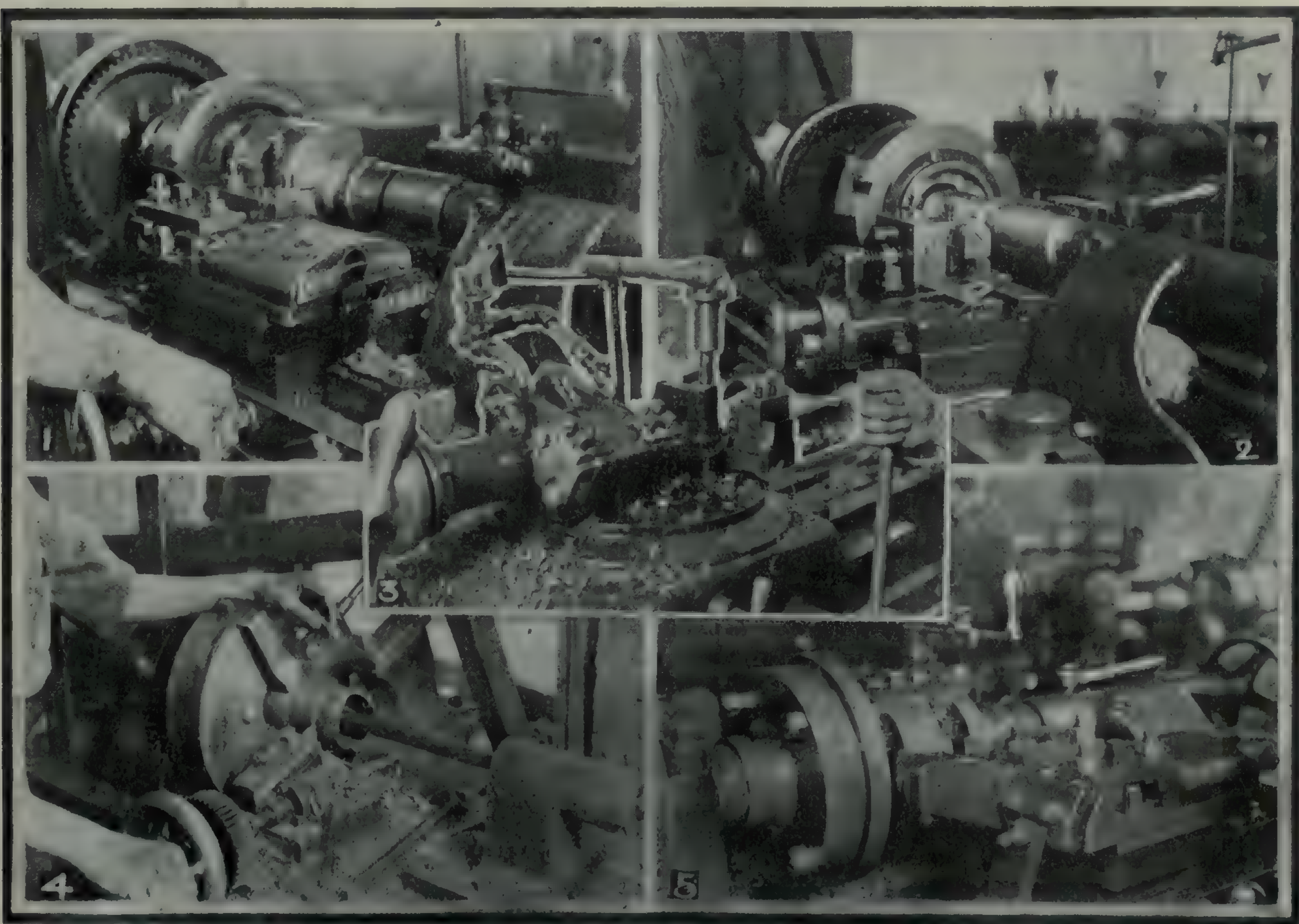


PLATE I. (1) A "MADE-IN-CANADA" WAVING ATTACHMENT HAVING A CAST IRON CAM ON THE FACE PLATE. NOTE FLAT SPRING TO KEEP ROLLER TOUCHING CAM. (2) BERTRAM WAVING ATTACHMENTS MOUNTED ON A McGREGOR-GOURLAY (CANADA MACHINERY CORPORATION) STANDARD ENGINE LATHE. (3) ROUGH TURNING ON A JONES & LAMSON LATHE. (4) CUTTING-OFF OPEN END OF SHELL FORGINGS ON A HURLBUT-ROGERS PARTING MACHINE. (5)—A "MADE-IN-CANADA" WAVING ATTACHMENT.

Before the shell is put on the expanding mandrel, there is placed on it near the open end, a small driving dog shown in Fig. 25, and the tail of this dog is fitted into a slot in the face plate of the machine. In this way the greater part of the strain of driving the shell is removed from the internal chuck.

The first metal removed from the shell in this operation is by a multiple-tool turning attachment fitted to the turret. The first tool rough turns the shell up to about two inches of the open end. As the operations on all five similar turret lathes fitted up for the work. The shell is next given a bath in hot soda water to remove all the oil and chips.

Cutting the Recess and Forming the Wave Lines.

The next operation is to cut the recess for the copper rifling bands and to form the wave lines in the bottom of this recess. The recess is placed less than one inch from the back end of the shell and that part of the shell between the back On the face of the flange which bolts to the lathe face plate, a triple cam is cast, this being used to form the wave lines in the bottom of the groove. The cam was not finished on a machine, the casting being merely smoothed up and the scale left untouched so that it would present a better wearing surface to the roller.

The shell is clamped in the hinged chuck against a stop, and the tail-stock is pulled up to it. A revolving centre on the tailstock spindle serves to hold the shell more firmly in the machine. The tail-

stocks of the lathes in use on this and many other operations are all fitted with a lever by which they can be quickly and easily moved on the ways. The carriage is locked to the ways of the lathe during the operation.

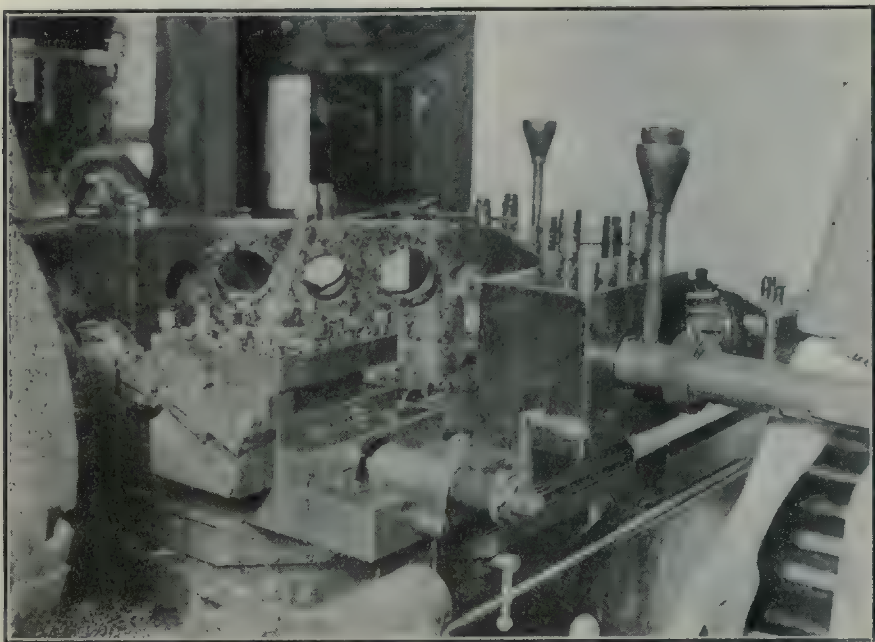


FIG. 7—AMERICAN TURRET LATHE FITTED UP FOR BORING 18-POUNDER SHRAPNEL SHELLS.

The first tool in this operation cuts the groove roughly to its width, the central portion of the groove being only cut down to a diameter slightly larger than the diameter over the top of the wave lines. On each side of this diameter, the groove is turned to finished depth. The tool is held in the turret tool post and approaches the work from the back, and a snap gauge is used to ascertain when these grooves are finished to the proper depth.

When this operation is finished, the turret tool post is swung around and two little right and left hand tools for undercutting the edges of the recess are fed into the bottom of two little full-depth grooves. A small hand lever actuates a cam which feeds these two tools into the work in a direction parallel to the long axis of the lathe. These two tools widen out the recess to a finished size and at the same time undercut the edges. The hand lever by means of which these tools are fed into the work comes up against a stop when the finished width of the groove is obtained. The tools are withdrawn, and then the waving tool is next put into action, the cross slide being moved toward the centre of the lathe. The carriage remains locked to the ways throughout the operation. Just before the roller comes in contact with the bevel on the edge of the wave cam, the direction of rotation of the lathe is reversed, and the roller moves over on the cam with comparative ease. A plain, flat spring, shown in Fig. 1, Plate I, keeps the roller in close contact with the cam.

FIG. 9—HEAT-TREATING SHELLS WITH CANADIAN HOSKINS FURNACES AND OIL TANKS.

The tool is fed into the work and it cleans up the bottom of the recess groove to size and forms the little wave lines in the bottom of the groove. A heavy oil cutting lubricant is used.

When the tool is withdrawn, the spring pushes the tool slide up against the stop shown in Fig. 5, which stop simply consists of set screw and locknut in a bracket bolted to the lathe carriage. This tool is being worked constantly and is giving the greatest satisfaction both with regard to quality and quantity product. Only one tool of this description is in use in the plant at the present time.

To perform this grooving and waving operation, the John Bertram & Sons Co., Dundas, have designed a fixture and two of these attachments have been fitted to a standard Canada Machinery Corporation engine lathe and a McGregor-Gourlay engine lathe respectively. Fig. 2, Plate I, shows the tool attached to a McGregor-Gourlay engine lathe. Bolted to the face of the chuck is a triple face cam, and the fixture which carries the tools is clamped rigidly to the ways of the lathe. On the near side of the machine, the waving tool is placed, being mounted on a sliding toolholder, on one end of which is placed the bracket which carries the cam roller. A stiff spiral spring presses on the opposite end of the sliding rest which always keeps the roller pressing firmly against the cam on the chuck face.

The waving tool is of much the same design as the tools employed in other fixtures designed to do this work. The tool-holder is itself fitted in a little slide, along which it is moved when fed into the work. A stiff spring keeps this tool-holder pulled out of, and back from, the work. On the far side of the fixture, clamped to the ways of the lathe, are located the two undercutting tools. These are also fastened into little slides, but are fed into the work at an angle to it, thus forming the undercut. The tools are so ground that the bottoms of the two grooves thus cut, are parallel to the longitudinal axis of the shell. Both of these tools are held out from the work by means of coil springs.

A third part of the tool, which is clamped to the lathe carriage, consists of a fixture in two parts, carrying three cams. In operation, the carriage is moved toward the headstock of the lathe by means of the feed screw, and one of the cams, as it travels, forces the waving tool on the near side of the lathe into the work and at the same time the face cam causes the tool to oscillate. The shape of the tool cutting edge forms the wave lines in the bottom of this groove. Simultaneously the two cams on the back of the lathe

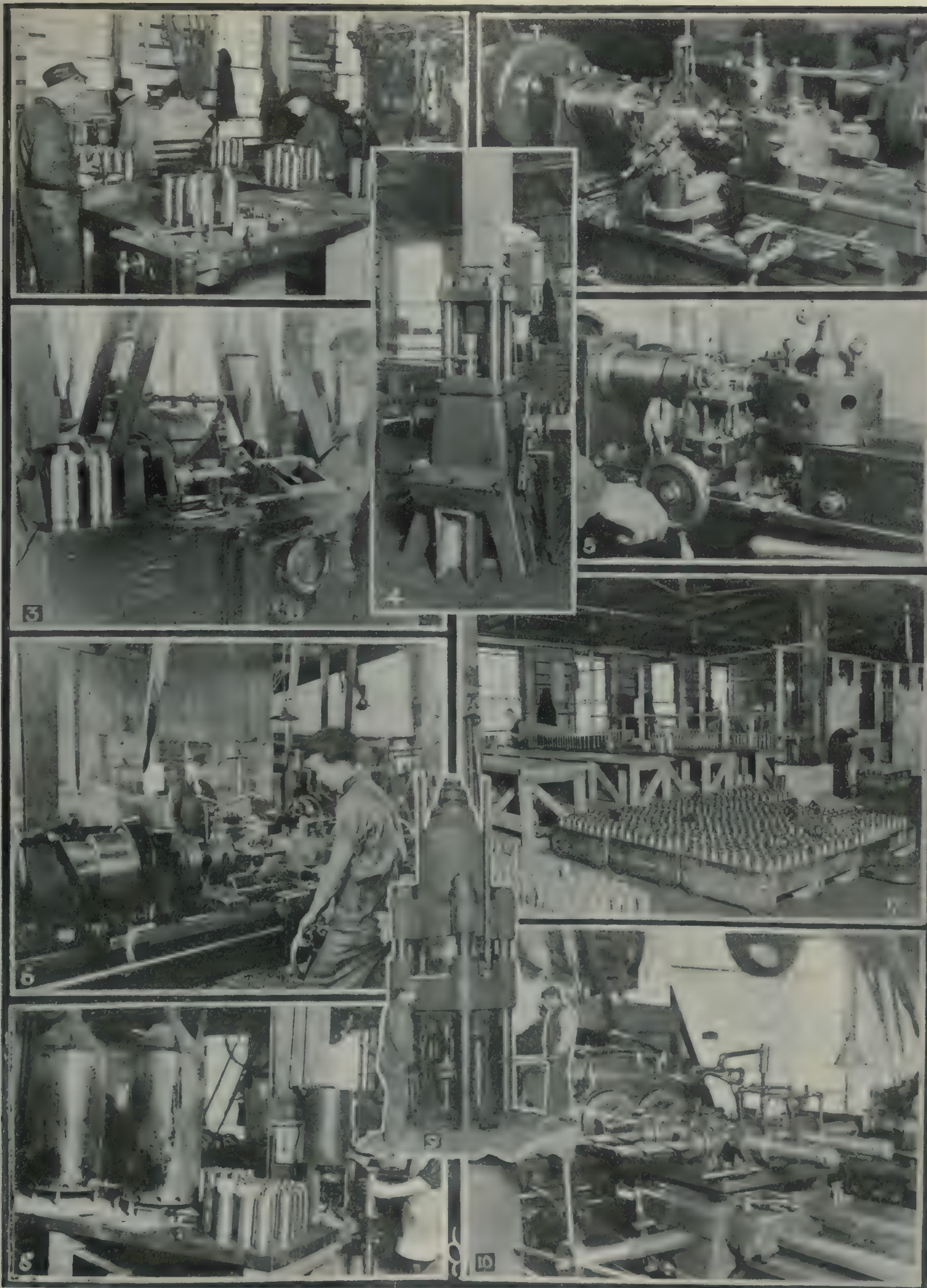


Plate II—(1)—Final assembling department operations. (2)—Finishing brass sockets on a Warner & Swasey brass turning lathe. (3)—Finishing inside of shell nose, collapsible tap just entering (C.M.C. turret lathe). (4)—Goldie & McCulloch nosing press. (5)—Turning copper rifling bands on a standard turret lathe. (6)—Grinding shell bodies to a finished diameter. (7)—Painting department and Government inspection in distance. (8)—Filling shells with shot and resin. (9)—350-ton R. D. Wood shell forging press. (10)—Boring shells on a two-spindle Jones & Lamson turret lathe.

carriage feed the two under-cutting tools into the work. The cams are so designed that they feed these tools into the work to the proper depth, and the feed screw regulates the speed with which the carriage travels and therefore the speed with which the tools are fed into the work.

The under-cutting tools are so designed that they clean up the edges and bottom of the groove to the proper depth and width, and the whole operation is most rapidly accomplished. Fig. 26 shows a sketch of this tool which is accomplishing such a difficult operation in so short a time. The shell is placed in the chuck against a stop which ensures the proper location of the recess, and the cutting tools are held clear of the work because of the springs. The other end of the shell is supported by a revolving centre held in the tail-stock spindle. After this operation, the shell is carried to the hot soda water tanks to be washed.

Boring Powder Pockets and Diaphragm Seats.

The boring operations are carried out entirely on turret lathes, there being three different types of these machines somewhat similarly tooled upon which the boring and the rough taper turning of the nose is done. The first type of turret lathe is an old type American heavy-duty machine, a cut of which is shown in Fig. 7. A hinged chuck is fastened to the face-plate of the turret lathe by means of cap screws. The first tool to enter the work has a wide cutting edge ground at an angle, and this tool removes the shoulder formed by the rough turning operation, and turns the end of the shell at a taper. The tool is not travelled along the work, but merely fed into it, and its wide cutting edge ground on a bevel forms the taper. This tool is shown in operation in Fig. 7. Heavy lubricating oil is used as a cutting lubricant.

The next operation is the rough boring of the powder pocket. The tool for this purpose is quite clearly seen in Fig. 7. It is gashed for chip clearance, and a collar on the boring bar acts as a stop when the tool has reached the bottom of its cut. The rigid construction of the boring bar is seen in Fig. 7, as also is the solid construction of the turret. The oil is carried to the machine through the pipe shown in the upper left-hand corner of the cut, and is allowed to flow into the funnel in the tool bar and thence through a duct in the tool bar to the tool. The turret is then swung around and the next tool is also a gashed cutter to rough bore the diaphragm seat. A swing of the turret brings a boring bar carrying the two finish boring tools into operation. Oil is fed into the funnel-shaped duct and led through the bar to the cutters.

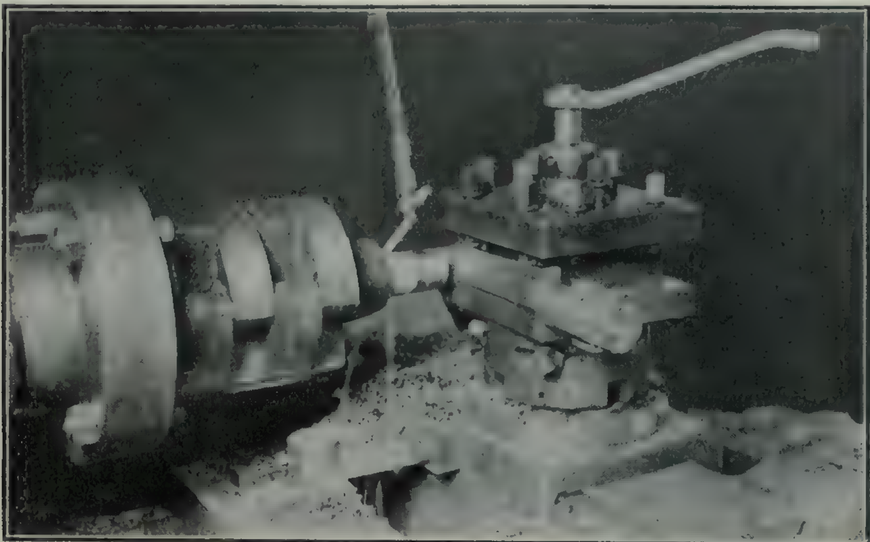


FIG. 11—IMPROVISED TURRET ATTACHMENT ON A STANDARD ENGINE LATHE.

Both the finish cutters for the powder pocket and the finish cutter for the diaphragm seat are carried in this boring bar, the former vertical and the latter horizontal. These cutters are not gashed, and a stop-collar on the boring bar indicates when the bar has been fed in the proper distance. By putting in both finish cutters together, the distance that the diaphragm seat is above the bottom of the powder pocket is fixed. Also, the two cutters, one placed vertical and the other horizontal, have a tendency to make the boring bar much more rigid.

The next machine to this is a flat turret lathe of the latest Jones & Lamson design. This machine was built and tooled especially for its work by the manufacturers. The shell is chucked in the standard chuck of the machine and placed up against a stop and the boring bars are most rigidly clamped to the turret, from which three boring bars radiate. One bar extends right across the turret, is clamped in the two supports, and has tools in both end extensions. Another bar passes right through the clamp on the turret, and its extension is mortised into the first bar. In this way an extremely rigid arrangement is obtained.

The first tool to enter the work is the roughing cutter for the powder pocket. The end of the nose is also faced and the outside of the nose is rough-turned taper with a tool having a wide cutting surface ground on an angle to the work.

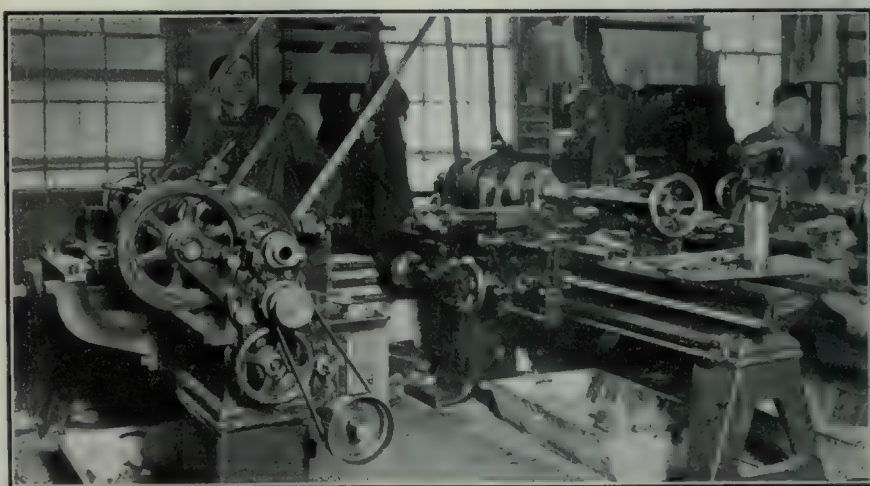


FIG. 14—FINISH TURNING SHELLS ON ENGINE LATHES. ONE MAN RUNNING TWO MACHINES.

tool on the shank end of the boring bar rough turns the nose of the shell for almost one-half to three-quarters of an inch straight, and then comes up against a stop arranged in the tool bar to come against the end of the shell. The next Oil is used as a cutting lubricant. The rough cutters here are also gashed for chip clearance. The turret is next swung, and the roughing tool for the diaphragm seat is then fed into the work. These two rough boring tools are placed ver-

tically in their respective boring bars. The finish cutters are both placed in one boring bar, the powder pocket cutter in this case being vertical and the diaphragm seat cutter horizontal. The roughing cutters are both placed in the opposite end extensions of the same bar, while the finish cutters are placed in the bar that is mortised into the larger bar.

The next turret lathe fitted up for boring the shells is a Jones & Lamson machine similar in design to the last one described, only that it is a double spindle machine. The tooling arrangement is somewhat different, however, from that of the single spindle machine, and can be seen in Fig. 27. The nose of the two shells are first turned taper, and the last half inch is turned straight; the ends of the noses are also faced to length. The turret is then swung and two 1 5-16 inch drills with their noses ground flat, are fed into the bottom of the powder pocket. These drills are plainly seen in Fig. 10, Plate II, as also are the other tools on the turret.

The next swing of the turret brings the boring bars carrying both gashed roughing cutters into position. Both these tools, one roughing the powder pocket, and the other roughing the diaphragm seat, are fastened vertically into one bar. Another swing of the turret brings the boring bars carrying the finish cutters into position. The finish cutters are fixed in the boring bars in a manner similar to that in which the finish cutters in the bars of the two lathes just described were fixed, namely, the powder pocket tool vertical, and the diaphragm seat tool horizontal. Stops on the machine indicate when the tools have been fed into the required depth. The same rigid principle of having one set of boring bars extend directly across the turret and of having the other bars mortised into these, has been here also applied. The machine is doing accurate work, but the firm is not yet satisfied with the number of shells turned out per day.

FIG. 15—GOLDIE & McCULLOUGH CO. BANDING PRESS IN OPERATION.

Heat Treatment.

Before any more machine operations are done on the shell, it passes to the heat treatment department. There are two Canadian-Hoskins oil furnaces in this department, each capable of holding eight shells in a batch. The furnaces are shown in Fig. 9. The shells are placed in the furnaces with a pair of tongs and allowed to remain there from fifteen to twenty minutes, during which time they are heated to about 1,450° F. The shells are then removed from the furnace by tongs and placed in a tank of whale oil and quenched. These tanks are merely square vessels of boiler plate and were built in the boiler department of the works.

When the shell is quenched it is picked out of the oil tanks by tongs and placed on a wire gauze shelf to allow the oil to drain from it, the oil being collected in a sheet metal hopper below. Later, the last traces of surplus oil are removed by tumbling the shells in boxes of sawdust. The shells now pass on to the annealing furnaces, after which they are put on a wooden taper mandrel driven from an old emery grinder. They are here cleaned up and all scale removed. The shell is next tested for hardness with a Shore scleroscope, being afterwards taken back to the heat treating department, where the nose is heated in a lead pot to about 1,400° F. The lead is kept hot by means of a Hoskins oil furnace. The shells are placed over two rods which project out of the metal the necessary amount to give the proper depth of immersion to the nose of the shell. Powdered charcoal is spread on the top of the molten lead to reduce the radiation and oxidation, and also to reduce the tendency of the lead to adhere to the steel shell.

When the nose is heated, the shell is placed in the nosing press, shown in Fig. 4, Plate II. This machine was built by the Goldie & McCulloch Co., and is hydraulically operated. Hydraulic pressure is obtained from a vertical two-cylinder pump, belt driven from the line shaft of the shop. The pump discharges into an accumulator which is equipped with an automatic cut-out, which controls the water supply to the pump. Before closing in the nose, the steel disc in diaphragm is placed in the shell, it being of too large a diameter to pass through the nose after it has been closed in. Immediately the nose has been closed in, the shell is taken from the nosing press with a pair of tongs, and the nose is placed in the lead pot again for a short time to remove all traces of chill caused by the nosing process. The shell is then allowed to cool slowly in the air.

Finishing Inside of Nose.

When the shell comes to the engine lathes for the finishing of the inside of the nose, the steel diaphragns inside of the shell might possibly come down into the nose and get fouled with the tools, so, to prevent this occurring colored cotton waste is packed into the shell which holds the diaphragm to back end of the shell. Fig. 11 shows the shell in an engine lathe being machined, and as will be seen, the shell is clamped in a hinged chuck which has been bolted to the face plate of the lathe. The chuck has been bored, so that the shell when slid into it is pushed up against a stop, and when the nuts are tightened on the clamping bolts, the shell is firmly held in position. The lathe has been fitted with an improvised turret tool post on the carriage, the details of contruction of which, are clearly seen.

The first operation is the final facing of the end of the nose. The carriage is run up against a stop clamped to the ways of the lathe and, when the carriage is thus placed, the tool is run across the face of the nose and the shell faced to length. Next, the turret tool post is swung around, and the tool for boring the inside of nose is swung into position. The cross slide is run across the carriage until it is against a stop, and, when the cross slide is in this position, the boring tool is correctly located to bore the nose roughly to size.

In the same boring bar is fitted a two-edge reamer, this tool being so placed that soon after the boring tool passes out of the cut, this reamer follows and reams the nose to size. The bar is shown quite distinctly in Fig. 11.

The next operation is to turn the inside of the nose and form it for some distance

FIG. 21.

behind the portion which was bored straight in the operation just described. This is being accomplished in Fig. 11. The tool slide has a fixture bolted to it which extends towards the face plate of the lathe, as can be easily seen in Fig. 11. In the end of this fixture, a hardened steel pin is placed. Another fixture is bolted to the ways of the lathe and on the top of this fixture is screwed a piece of flat machinery steel about one inch thick, and one side of this is ground to the exact profile to which it is desired to turn the inside of the nose. This steel has been

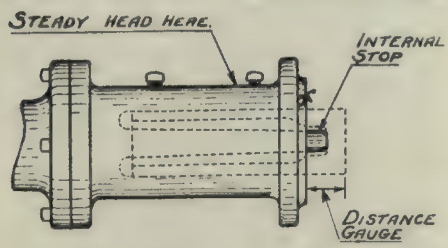


FIG. 22.

hardened. The boring tool in the bar is fed into the nose and then the cross-slide is moved toward the operator and the little hardened steel pin in the fixture in the cross slide is brought up against the curved profile of the piece of steel on the fixture bolted to the ways of the lathe. Thus, the tool is located. The carriage is traveled toward the face plate by the power-driven feed screw and the operator keeps the cross slide pin firmly against the steel template by applying a constant pressure to the handwheel connected to the cross feed screw. Thus the proper profile is turned.

The next operation is to tap the end of the nose, but owing to the fact that the speed of the lathe must be lessened for this operation it is not done at this time. Ten shells are finished up to this point and then each is removed from the chuck. Upon completing the tenth shell the operator changes his lathe speed and runs-in a collapsible tap usually fastened in the tailstock spindle. The other nine shells are rechucked and tapped, thus completing the operation. Several lathes are fitted up with similar tooling and all are doing good work.

Fig. 3, Plate II, shows a Can. Machy. Corporation turret lathe tooled up similarly to that just described, and is shown with the collapsible tap mounted on one of the turret bars and just entering the shell. It will also be noted that this chuck is similar to that on the other lathe, just described.

From these machines the shells are taken to a McDougall vertical drill press which is fitted with a collapsible tap in the spindle. On the drill table a hinged chuck is placed into which the shell is put and clamped there. A tap is run through the nose again to ensure the thread being the proper diameter. This last tap is kept adjusted to within the closest limits and it ensures all the threads in the noses being practically uniform.

Finish Turning and Grinding.

The shells now all pass to a table where steel plugs are fitted into the noses. The plugs have a square shank extension in which a centre is located. The plugs being screwed home solidly, the shells are then taken to certain lathes where they are turned, the lathes used for this work being all specially fitted up. They are all equipped with compound rests, and the crossfeed screw is disconnected. To the frame of the lathe at the back, a long piece of flat machinery steel is bolted by means of a couple of brackets, and one edge of this steel piece is ground to the the exact contour or profile of the shell, and hardened. At the back of the cross slide of the lathe is a fixture, on the end of which is a hardened steel point, and this is kept in register with the profile of the steel template by either of two means. The first is by placing two little sheaves on the rear edge of the carriage and having two weights attached to the two ends of a piece of small steel rope, and this rope is led over the sheaves and attached to the cross slide. The other method is to have a couple of springs made of coarse steel spring wire to keep the cross slide closely following the template. All tool adjustments are made by means of the compound rest feed screw.

The production policy has been not to remove too much metal during the first rough turning operation on the J. & L. turrets, because, during the succeeding operations, the metal might become warped and not true up to the finished diameter. Two lathes are fitted up in the manner indicated, and the shells are brought to these lathes for a second roughing cut with an extremely coarse feed at the highest possible speed, the shell being rough-turned to the exact finished profile and to within a very close margin of the finished diameter. The shell is placed in a solid chuck up against a stop, and a set screw clamps down a little wedge-shaped piece of brass by which it

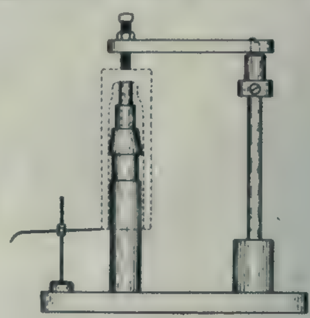


FIG. 23.

is held and driven. This chuck is shown in Fig. 28. In both of these rough turning lathes a heavy steel spring is used to keep the cross slide up to the profile of the templet. The first lathe is a Bertram machine and the spring is made of square spring steel while the second is a David Pond machine with a round steel spring to keep the cross slide in position.

From here the shells pass on to the final turning or grinding, the former being accomplished in much the same manner as described in the rough turning and forming operation. Fig. 14 shows two Stevens lathes tooled up for finish turning, the profile of the steel template at the rear of the lathe to the left being easily distinguishable, also the hardened steel pilot. These two machines are arranged for one-man operation. The lathes equipped for final turning are all arranged in pairs and one machinist always runs two machines. All are equipped with solid chucks, each

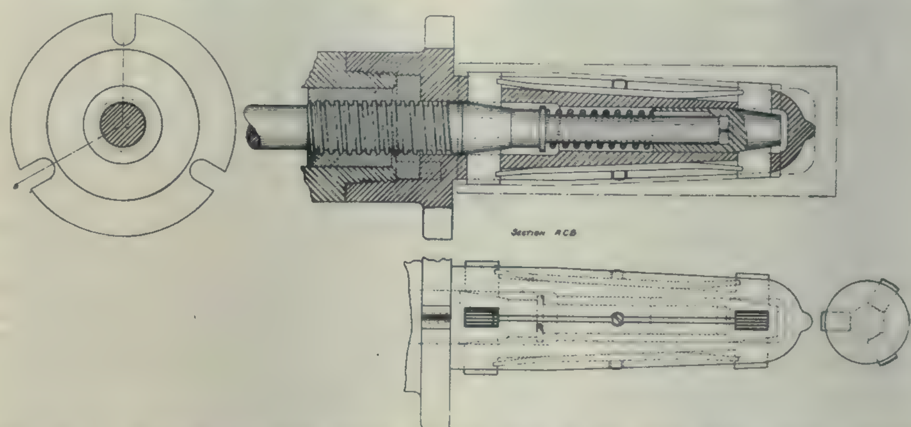
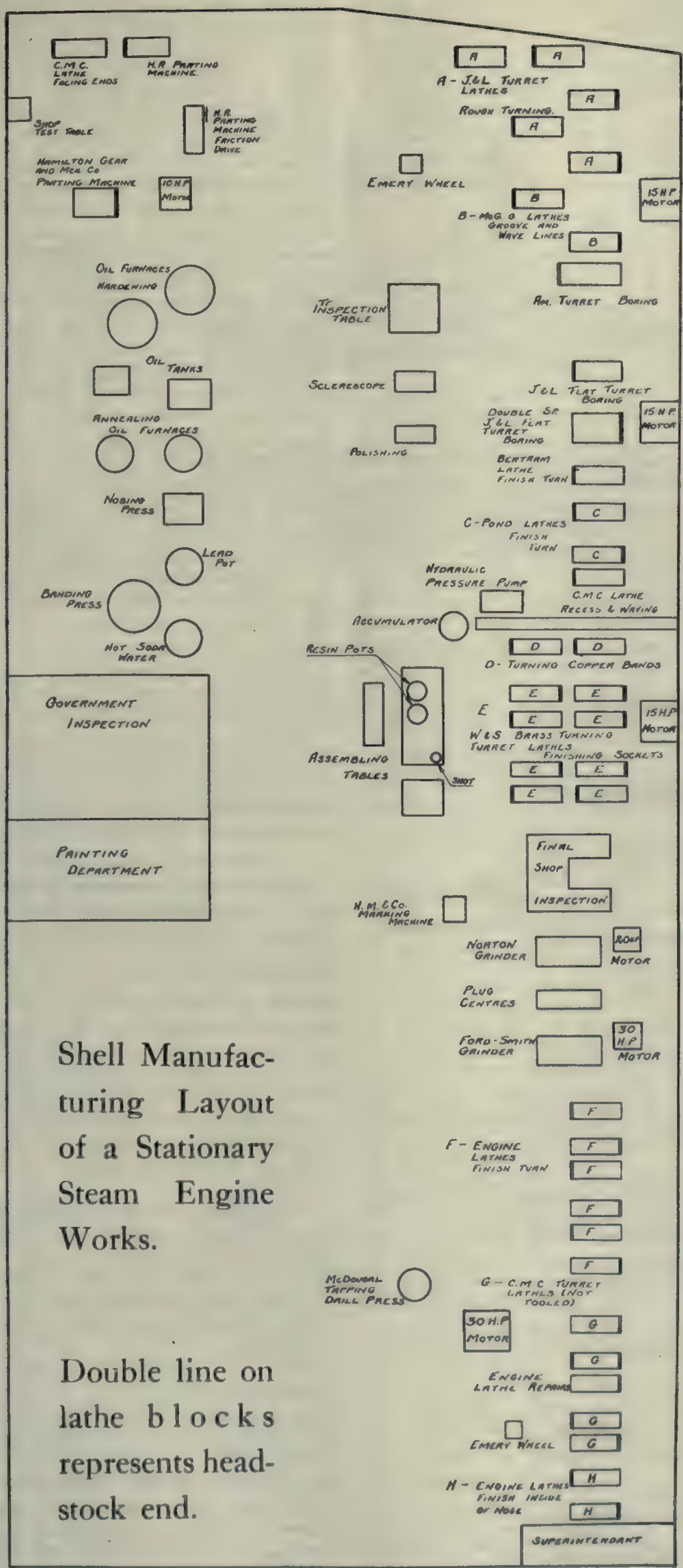


FIG. 24—R. McDOUGALL EXPANDING CHUCK FOR 18-PDR. SHRAPNEL SHELL WORK.



SHELL MANUFACTURING—LAYOUT OF A STATIONARY STEAM ENGINE WORKS.

having a brass wedge set by a set-screw, the shells being placed up against a stop in each case. The shells are carefully calipered and all tool adjustments are made by means of the compound rest. Special attention is given to the grinding of the tools so that a clean cut and a smooth finish be obtained. The final cuts are made dry.

There are two grinding machines upon which the shells are finished to diameter in two operations. The grinding is done in two operations on the same machine; the first is the body grinding and the second is the nose grinding. The bodies of forty shells are ground, and then the noses are ground on the same number. It takes some few minutes to change the wheels on the grinder so it is proposed to raise the number in a batch from forty to one hundred and twenty. On the body grind an 8-inch wheel is used, and this is frequently dressed with a diamond. The nose is ground with a narrow face wheel which has been dressed to the proper curve to give the correct form to the nose. The first machine is of Norton make, and is driven by an individual 20 h.p., 220 volt, d.c. Westinghouse motor. The small end of the shell is the driver and a dog is fitted over the square end of the plug centre which is inserted in the shell. The other end of the shell is supported in a revolving centre. The second grinder is a Ford-Smith machine, and it is driven by its own 30 h.p., 220 volt, d.c. Westinghouse motor. The back end of the shell is placed in a chuck in this machine and the other end is supported by the tailstock spindle. Fig. 6, Plate II, gives a view of this machine and also shows two finished ground shells on the machine to the left. A little difficulty was at first experienced in getting the shells ground true, but later results have been entirely satisfactory.

The shell now has the wave lines nicked in three places with a cold chisel to allow any air trapped between the ribbed lines as the bands are pressed on, to escape and let the copper band fill the central space entirely. It then passes into the hands of the Government inspectors, for a preliminary inspection, the machine work on the shell proper, having been accomplished.

Pressing and Turning Copper Bands.

The shells are next taken to the hydraulic banding press which is a product of the Goldie & McCulloch Co. This press is situated near the nosing press and receives its water under pressure from the same tank and accumulator that serves the nosing press. The copper band is slipped over the end of the shell and is struck a hammer blow which causes it to go into the groove or recess and remain there. The operator then places the shell in the machine, the six jaws of which closely press the cop-

per into the undercut edges and imbed the waved lines into the copper band. The jaws being released, the shell is turned slightly, after which the jaws again close on the band. This insures the band being driven home for keeps. Fig. 15 shows the banding press and two shells with the copper bands pressed on them. The shells are now taken to the band turning lathes, and the nose end is placed in a chuck, Fig. 5, Plate II. The shell is placed up against a stop in the chuck and to the turret is attached a revolving centre. The cutting tool is ground to the profile of the rifling band and is fed into the work. The proper diameter is determined by means of a pair of calipers or a limit snap gauge. Two lathes are fitted up to do this work.

Assembling.

The shells next go to the assembling department. The tin powder cups are here placed in the powder pocket, and the brass powder tube is screwed into the diaphragm and the powder cup. The shot filling is the next operation. Fig. 8, Plate II, shows this. Steam pipes can be seen leading down into the shot box so as to keep the bullets warm. The shell is placed on an air vibrator and a funnel placed in the nose end. This funnel is shown in Fig. 29. The central rod runs down the powder tube and centres it, while the turned portion on the bottom

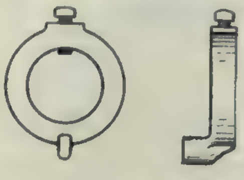


FIG. 25.

of the outside of the funnel just fits inside the threaded nose. The shells are jarred down by the air vibrator and are afterwards put on a balance and weighed. Thus the proper number of shot is determined by weight rather than by a mechanical measurement of the volume.

The shell is now put under the resin pots, which are heated by gas burners, and filled with molten resin. The warm shot keeps the resin fluid until it fills the shell spaces completely. Small wooden plugs are placed in the powder tubes to prevent the resin from getting in them. The resin pots are shown in Fig. 8, Plate II. The shells are again weighed, and one or two pieces of buck-shot are added to secure the correct weight. When the shell is of the proper weight, the brass socket is screwed on, but before doing so, its thread is coated with red lead. The socket is inserted a turn or two by hand and then the shell is clamped in a hinged vise and a 24-in. pair of pipe tongs are used to screw the brass socket home. A little steel plate is placed over the top jaws of the tongs to keep them from slipping down and injuring the finished steel portion of the shell. As the brass socket is screwed home, the little powder tube projects through the socket. A little plug of felt on a small wire is let into the powder tube to keep dirt out of it, these felt plugs being cut with a belt punch.

The powder tube is next soldered to the socket. The soldering irons are of a special shape, and are kept hot in electric pots of molten solder. Thus, the soldering iron has a supply of solder on it when withdrawn from the solder pot. A further supply of solder is, however, added by means of a piece of wire solder coming up through a hole in the assembling table. This is also applied to the hot soldering iron. The shell is now assembled and goes to the brass turning lathes to have the socket finished up.

Finishing Brass Sockets.

This operation is accomplished on several Warner & Swasey and MacGreggor-Gourlay turret lathes speeded up so as to be able to turn brass to advantage. The shell is placed in self-centering chucks of various types and the blank end securely gripped. It is further supported by a steady rest as will be seen in Fig. 2, Plate II. The first operation is to clean up the projecting end of the powder tube and cut it off flush with the bottom of the socket. This is done with an L-shaped tool, and is a simple operation.

The outside rim of the brass socket has up to the present never had the scale removed from it. The next operation rough turns this rim to somewhat near the finished size and form. The turret is swung around to bring this tool into position, and at the end of this operation the turret is again swung, this final movement bringing a tool into position, the cutting edge of which is ground to the proper profile of the finished socket. This tool is fed into the work and forms the outside curve of the socket. Still another operation is, however, necessary. The extreme outside edge of the socket is turned down to a slightly smaller diameter than this last tool cuts the socket. Thus, another swing of the

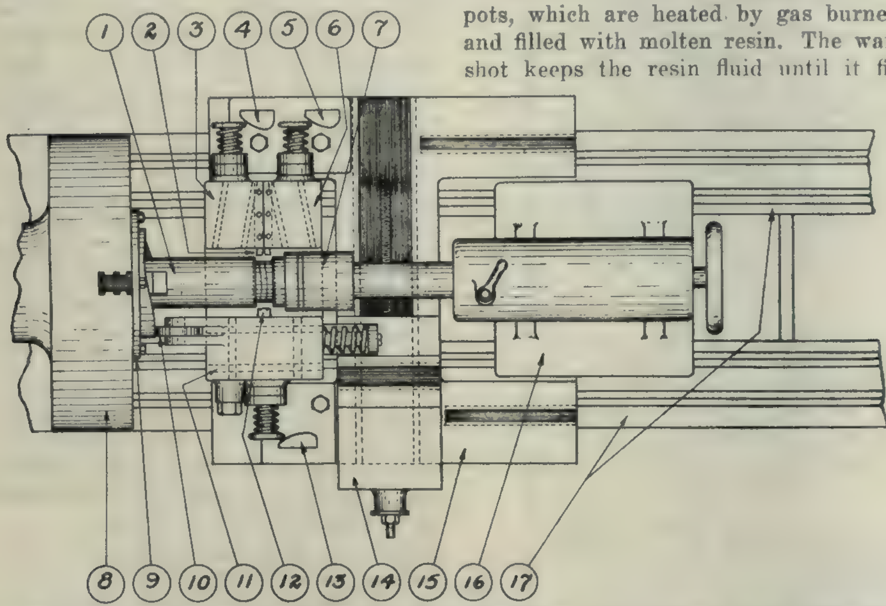


FIG. 26.—DIAGRAM ILLUSTRATING THE BERTRAM ATTACHMENT FOR RECESSING AND FORMING WAVE LINES IN THE GROOVE FOR THE COPPER RIFLING BANDS ON AN 18 PD. BRITISH SHRAPNEL SHELL. KEY FOLLOWS:—

(1)—18-pdr. Shell Forging.
(2)—Tools for cutting the outside edges of the recess to depth and under-cutting the edges. Tools are fed in at an angle to the work as the tool holders are mounted on an inclined dove-tailed slide as indicated by the dotted lines.
(3)—Tool holder mounted on a dove-tail slide which feeds the tool in at an angle to the work. Bottom of slide clamped to lathe bed.
(4)—Cam mounted on a fixture which is bolted to the carriage of the lathe and as the carriage is travelled toward the head stock of the lathe the cam pushes the tool holder (3) inwards thus feeding the tool into the work, at an angle so that the edges of the groove will be undercut.
(5)—Same as (4) but it feeds in the tool that cuts the other edge of the recess.
(6)—Same as (3) holding tool for the opposite side of the groove.
(7)—Revolving centre on tail stock spindle.
(8)—Lathe chuck on live spindle.
(9)—Steel face cam bolted to the face of the chuck.
(10)—Roller which is kept against the face cam by the square steel spiral sprnig. This roller oscillates the tool holder (11).
(11)—Tool holder for wave line forming tool.
(12)—Wave line forming tool.
(13)—Cam for feeding wave forming tool into the work. Tool holder (11) is a compound holder. The top portion is mounted on a dove-tail slide which is parallel to the ways of the lathe. The second or middle portion of the holder is mounted on a dove-tail slide which is at right angles to the ways of the lathe. The bottom portion of the slide is clamped rigidly to the lathe bed. The cam is mounted on the lathe carriage and as the carriage is moved toward the head stock the cam feeds the tool into the work and the face cam on the chuck oscillates the top portion of the tool holder, to which the tool is clamped, thus forming the wave lines and cleaning up the central portion of the bottom of the recess.
(14)—Cross Slide. (15)—Carriage. (16)—Tail Stock. (17)—Ways of lathe.

turret brings this tool in position and the final cut on the outside of the socket is made and at the same time the end of the socket is faced. Thus, a little shoulder is formed, the distance of which from the end of the nose has to be care-

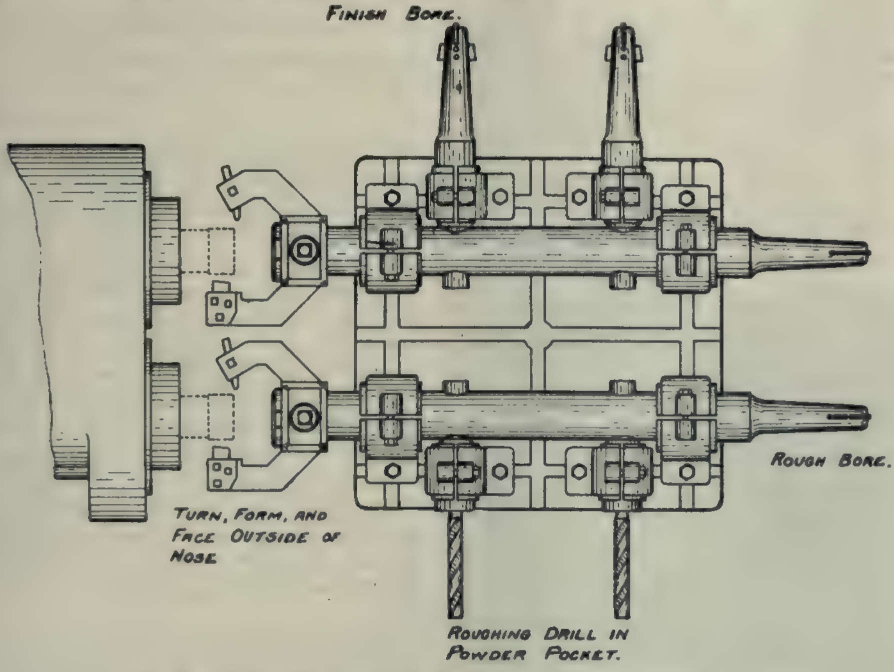


FIG. 27 TOOLING OF DOUBLE SPINDLE FLAT TURRET LATHE.

fully gauged. The nose is not faced off square but the inside is bevelled so as to produce a better seat for the timing fuse when it is finally placed on the shell.

Final Operations and Painting.

The shell now passes into the final shop inspection department, this being shown in Fig. 1, Plate II. Here a tap is run in the nose of the brass socket to clean out any burrs that the finishing operations of the socket have left in the threads. The form of the seat for the timing fuse is also gauged. A little tap is then run through the small hole in the side of the socket, where a little grub-screw is placed to hold the timing fuse in any required position.

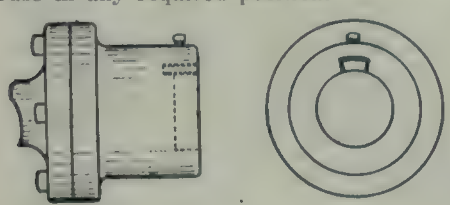


FIG. 28.

Next the felt plug is taken from the powder tube and then the powder tube is reamed to clean up any burrs which may have been left on its edges. Then a rag on a little steel rod is run into the powder tube to clean out any chips. The shells are weighed again on a delicate pair of scales. The brass caps are next screwed into the sockets and the shell passes on to be marked. Ordinarily, the shells are marked on a special Holden-Morgan marking machine, but, owing to this machine being moved to a new position the men are seen in Fig. 1, Plate II, marking the shells by hand.

Fig. 7, Plate II, shows the painting department in the foreground. The shells are painted by hand after having passed through the final Government inspection, which department is shown in the background of the same figure.

CANADIAN SHELL COMMITTEE.

The personnel of the committee entrusted with the placing of orders for shells, etc., and the inspection and shipment of same is representative of both Canadian military and manufacturing interests, and is individually as follows:

David Carnegie, M.I.C.E., Ordnance Advisor.

Brig.-Gen. Alexander Bertram, Chairman of Committee.

Brig.-Gen. T. Benson, Master General of Ordnance.

Lieut.-Col. Thomas Cantley.

Lieut.-Col. C. G. Harston, Chief Inspector of Arms and Ammunition.

George W. Watts.

Lieut.-Col. F. D. Lafferty, R.C.A., Supt. Dominion Arsenal.

E. Carnegie.

J. W. Borden, Accountant and Paymaster-General, Militia Dept.

The Shell Committee Headquarters is Drummond Building, Montreal.

General.

All machines are belt-driven from line-shafts or counter-shafts. The prime movers are 220-volt, d.c. Westinghouse motors placed in timber cages suspended from the ceiling timbers. The shells are transported about the shop on platforms each containing forty shells, and these platforms are built to be accommodated by the Cowan and Chapman transfer trucks are employed for the purpose.

Only 18-lb. shells are machined in this plant, which thus only requires one set of tooling. The size of the shop is 200 feet x 60 feet approximately. Three shifts of men per twenty-four hours are worked. Each shift works eight hours with a twenty-minute interval at the end of each four hours. Thus, the shop actually works twenty-three hours out of the twenty-four. The operators are paid a certain sum per hour for their work, and the superintendent has assigned a certain production number to each machine, and if the operator exceeds this number during his shift, he receives a bonus for each additional shell machined.

The natural lighting of the shop is by means of windows in the side walls and a very generous monitor composed mostly of glass. Incandescent tungsten lamps of high power are used for artificial lighting. Each machine is also provided with a drop light.

A thorough system of shop inspection in conjunction with careful supervision

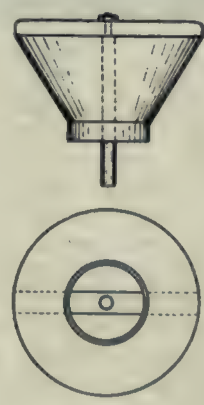


FIG. 29.

has enabled the plant to have become eminently successful in this work. The daily output at present is about six hundred shells.

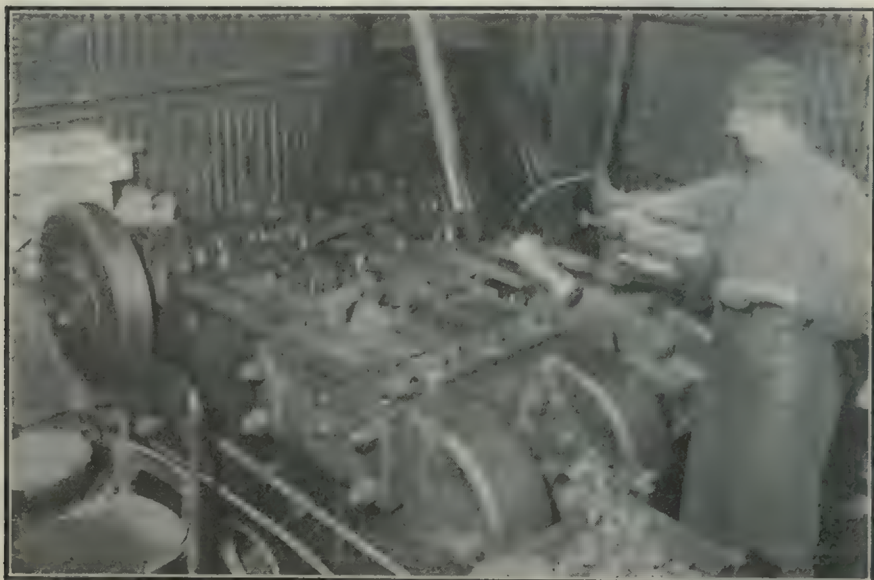
Countermining.—This consists of destroying a marine mine-field by the laying of a fresh line of mines across it and exploding them. An ordinary line of countermines would number fourteen 500 lb. mines. These are laid by specially built boats which are towed by fast steamers across the field, or by specially built launches. The work is extremely hazardous because of the danger of both mine explosion and of enemy gun fire.

Shell Manufacture in an Electrical Engineering Plant

Staff Article

Uncertain as to the duration of the war, but with the desire to bear a part in furnishing our Empire with munitions of war while maintaining its normal manufacturing equipment practically intact, the institution here described has, by the investment of a small amount of capital and by drawing on the skill and aptitude of its staff, succeeded in achieving a highly satisfactory degree of success in the matter of shrapnel shell quality and quantity output.

THE accompanying photos and description are those of a plant whose normal equipment is particularly unsuited to the manufacture of shrapnel. At the time of the outbreak of the war, certain departments were very short of work, and the object of undertaking the shell business was not to make a specialty of it, but to fulfil a duty to the Empire and to the Dominion by keeping as many men employed as possible. The necessity of preventing interference with such regular work as is being done and of doing the work wherever the machines and appliances are available, has made impossible the adoption of any progressive system in the organization of the shell department. Much time and labor is lost in transferring the product from one department to another, which are, at times, considerable distances apart; further, the shell work must be done without disarranging in any way an otherwise carefully planned organization for the regular product.

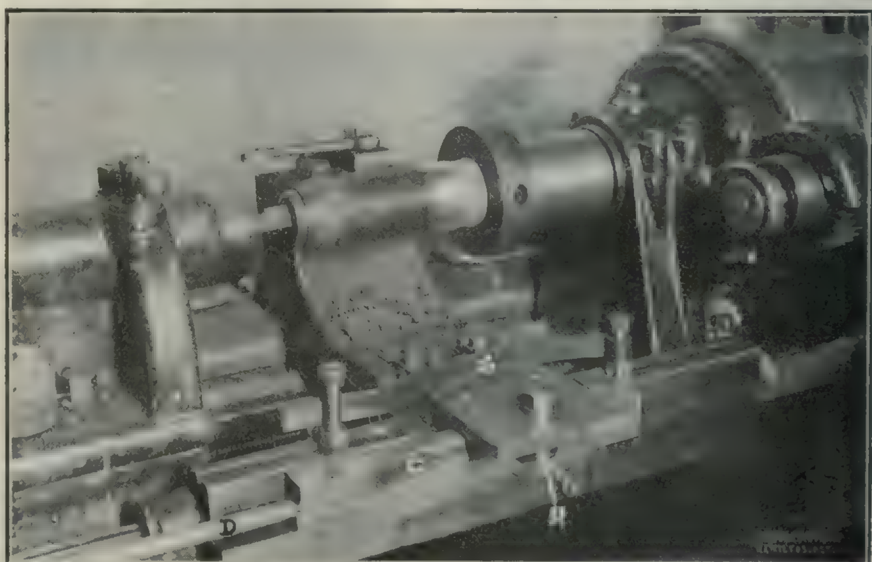


NOSING SHELLS ON "ACME" FORGING PRESS.

In spite of these and the natural difficulties, the undertaking as a whole has not only paid the overhead charges, but has been made a paying business. Very little, indeed, has been spent in extra equipment, and even though some of the improvised methods do not pay directly, the standard machines are paying their upkeep in time of stress. The staff is being held, money is kept in circulation, and our soldiers at the front are being well supplied with thoroughly reliable "goods." Taking all results into account, the officials of such a concern are deserving of considerable credit, which, on account of a pre-arranged plan of unobtrusiveness, will most likely be denied them.

The shell forgings are received from the steel plant by car loads in the usual way, and must first be ground on the ends and inspected for imperfections. Both ends of the forging have considerable excess metal to be removed, and most efforts to do this simultaneously by milling cutters have been unsuccessful. In the plant under consideration, the front or open ends are efficiently trimmed in an ordinary cutting-off machine, equipped with two cutters, while the back ends are faced on a pair of New Britain automatics. The rough turning of the body, and the finishing of the back end up to the groove for the rotating band, is done on a number of machines, including several Jones & Lamson turret lathes, a Warner & Swasey, and a Bullard boring and turning mill, the work being located by the inside upon an arbor.

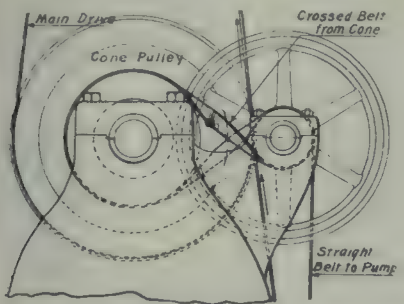
With the latter machine, it has been found most economical to do the rough facing at the same setting as the turning, which is carried up to the part which forms the nose. Two Reed-Prentice turret lathes, and one or two others equipped with Celfor high-speed drills of suitable form, are used to bore the powder chamber and diaphragm seat in one rough and one finishing operation. In this connection, there is used a very simple and effective method of producing a continuous flow of cutting compound to the tool. The work is driven directly by the belt, leaving the back gear free. One of the cone steps not in use is cross-belted to the idle back gear hub, from which another belt drives a



FORMING ATTACHMENT FOR ROUGH TURNING SHELL NOSE.

small centrifugal pump located at the base of the machine, and whose speed of rotation, and hence the supply of compound, can be varied by belting from a larger or smaller step of the cone.

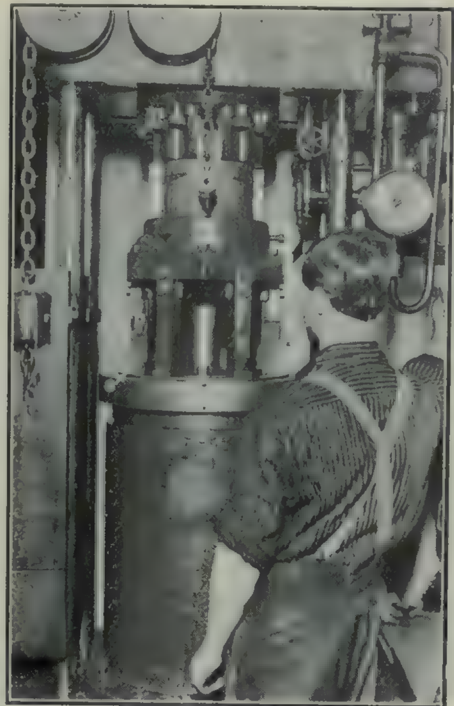
The treatment of the seat for the rotating band consists of three operations, i.e., grooving, waving and under-cutting. These are performed on three standard American lathes, equipped with face-cams bolted to the backs of the chucks, which give the carriage the necessary lateral motion. This is traversed by a hardened steel roller, attached to the



PUMP DRIVE FROM CONE OF STANDARD LATHE.

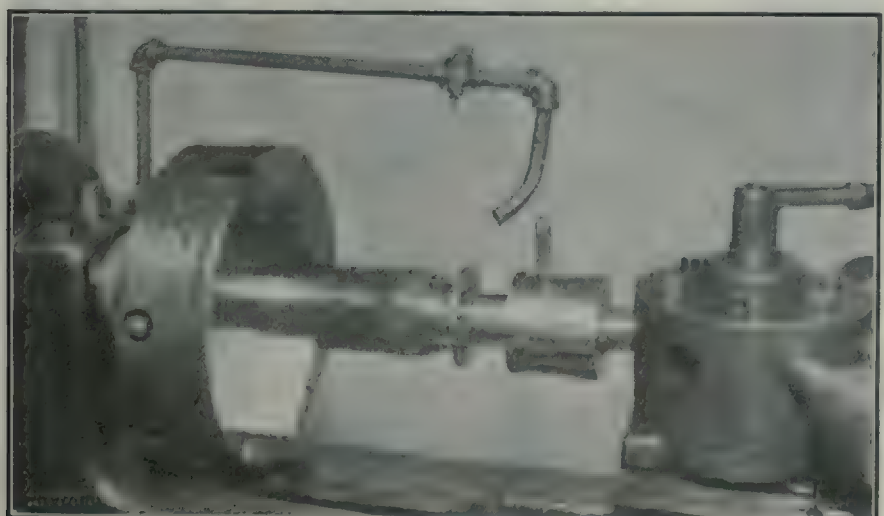
carriage, and held to the surface of the cam by springs. After rough turning, the shells go to the furnace for heat treatment. For this purpose several oil furnaces have been built, one each for heating and annealing in particular, having a capacity for a large number. The shells, after having been treated with boracic acid to prevent oxidation, are heated uniformly to the hardening temperature, and then dipped in the oil, open end first. From this they are transferred to the annealing furnace in sheet metal trays for convenient handling, and are raised to a temperature of 1,200 degs. F.

After the scleroscopic test for hardness, the shells are made up into groups or series of 120, from which the Government representative selects one for the tensile test, and another for the firing proof, leaving 118 to the credit of the plant. The open ends are now heated in a lead bath to a temperature of 1,500



QUICK ACTION HYDRAULIC PRESS TRANSFORMED INTO A BANDING PRESS.

degs. F. for the nosing operation, which is performed in an Acme forging machine. This method of nosing the shells, although at first the outcome of acute necessity, as there was no other suitable press in convenient proximity to the heating department, has been very successful indeed. The press has quicker action than most geared presses, and required very slight alterations for this work. The diaphragm, instead of being dropped into the shell, is placed upon the end of a rod which enters the shell in advance of the closing operation, and this keeps the disc well back out of the way of the die.

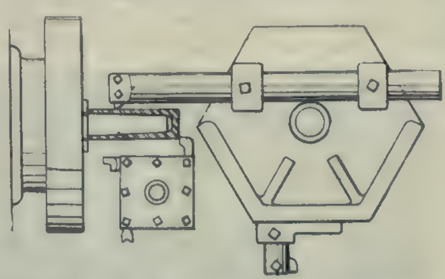


TAPPING FOR SOCKETS WITH COLLAPSIBLE TAP.

The shells now go back to the lathes for the next series of operations, which consists of boring, facing, recessing, and tapping the nose for the socket. For these operations a number of lathes are utilized, including Reed-Prentice, Canada Machinery Corporation, and others. The recessing is here done by means of a formed flat tool supported on a short boring bar from a monitor turret. It is necessary that the shell walls be of a certain thickness at this point, as well as conform to a curvature of specified form. The tapping of the nose to receive the socket is done on a single small Warner & Swasey lathe, using a collapsible tap and a quick-acting, self centreing chuck. This has been found to be rapid and economical, and moreover, a single tap does all the work.

Form Turning.

Next in order is the operation of rough turning the formed shell nose. The best results have been obtained from those not equipped with taper attachments. The vertical face at the back of the lathe carriage is faced off on a planer, and to this are attached guides for the forming cam bar. This cam, shown at C in the illustration, and on one side of which is worked the profile of the shell nose, is held fast by an adjustable rod, B, to



SIMPLE AND EFFICIENT ARRANGEMENT FOR ROUGH TURNING AND GROOVING.

the lathe bed, and, as the carriage moves back and forth, the roller R attached to the cross slide, imparts to it a lateral motion, which combined with the lengthwise motion of the lathe carriage, guides the tool so as to give the correct contour to the work. The roller and cam are protected from dirt and interference by the over-hanging extension to the cross-slide, and a neat flat spring, S, serves to keep them in continuous and close contact.

In the case of lathes fitted with a taper attachment, the taper guide bar is replaced by a plate in which a cam groove has been cut to suit the roller on the cross slide. This requires a weight to keep the roller up to the guiding face; the forming cam is more expensive to make, and the whole arrangement is less simple and less solid than the previously described method.

A considerable amount of difficulty was at first experienced in this, and in the rough turning of the cylindrical part of the shell. On account of the segregation of manganese and other causes, hard spots and in some cases considerable hard areas are often encountered, which resist all application of the lathe tool. The men engaged in this part of the work, however, have found that the troublesome shells can be sorted out by striking them in a certain way, and noting the sound given out. The hard shells go straight to the grinders for both roughing and finishing operations, and little time and effort is lost to the lathe man.

ANNEALING SHELLS IN QUANTITY BEFORE NOSING.

The grinding employs three Modern Tool Co., and one Ford-Smith machine. The methods adopted by the makers of these machines are carried out in either case. As is well known, the grinding of the shell on the Modern grinder is accomplished in two operations. First, the hardened cylindrical surface from the groove to the nose is finished by a flat wheel of the full width without traverse. The nose is ground in the same way in a subsequent operation on a formed wheel 2 ins. in width of face, and of a grade suitable for the softer material. The Ford-Smith machine is designed to finish the whole surface of the shell at a single operation by means of one formed wheel. The most interesting part of this equipment is the wheel itself, which is of varying bond and grit throughout its length of face to accommodate the different degrees of hardness of the heat-treated shell.

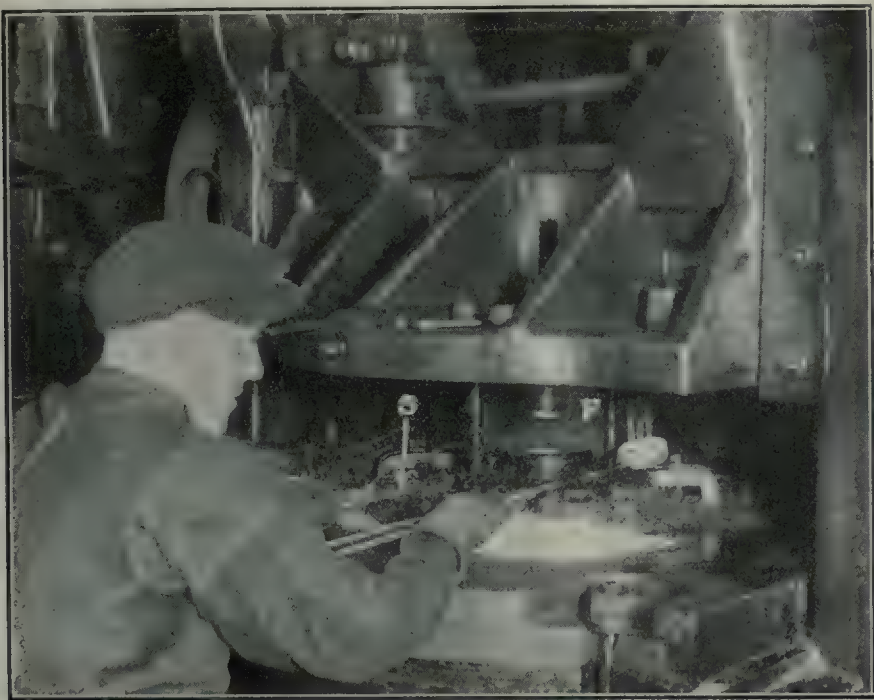
SINGLE PYROMETER DIAL ARRANGED TO SHOW TEMPERATURE OF ANY FURNACE.

As to the results gained by this arrangement, definite reports are not yet

ONE OF THE CONTINUOUS MELTING BRASS FURNACES.

CONTINUOUS POURING OF SLUGS FOR SOCKETS AND CAPS.

available. The form-grinding proposition has really resolved itself into a diamond problem, and the best solution of the grinding process offered up to the present time, is that the cleaning, and as much of the truing as possible, be done with the common disc type of wheel dresser, and that the diamond be used only for the finishing touches. The provision of an economical device for keeping the wheel to an accurate form would certainly add much to establish the supremacy of the grinding wheel in this work, as the question of power, speed, and wheel manufacture have been satisfactorily met. Considerable care is required when two operations are employed, to obtain a smooth continuous surface at the intersection of the two grinds.



FORGING SOCKETS FROM BRASS SLUGS.

Shell Banding Feature.

The shells now receive the first Government inspection, after which they are taken to the banding press. For the banding operation a hydraulic arbor press is utilized. The ram is fitted with six wedge cams as shown in the illustration. As these descend, a corresponding number of radial bars are forced by the wedge action towards the centre, and against the band to be closed. The reaction of the wedges is taken by the brass shoes S.S. and the bars are returned to the outside positions by springs. The ends of the slide bars which operate on the band are so shaped that the edges are pressed slightly harder than the central part, which ensures that the copper will be thoroughly forced into the under-cut. Two actions of the plunger complete the operation.

The bands are turned to the required shape by means of a special formed tool of the flat type, the circular formed tool having been found unsatisfactory for operating on the soft metal, as it is difficult to obtain the sharp clearance required. This work is done in small standard lathes, equipped with a special centreing chuck to hold the shell by the rear end, the front end being supported by a centre plug screwed in.

FINISHING SHELL SOCKETS ON SMALL BRASS LATHE.

The steel case is now complete except for the marking which is done immediately before or after the banding operation. This is largely done by hand with stamps, but a Bertram marking machine is being installed, which will no doubt greatly expedite this operation.

Assembling the shell with its contents forms the final series of operations. The steel diaphragm disc, to separate the powder from the bullets, has already been inserted at the time of nosing. The tin powder cup is now placed beneath this in the chamber provided for it, and the brass tube is screwed into the diaphragm. The shell is now stood on a vibrator plate, and is kept in rapid quivering motion while the bullets are poured in from a scoop calculated to hold approximately the correct number, which is afterwards tested by weighing the shell.

The open end of the tube is now plugged and the rosin is run in around the bullets from a gas heated pot, with provision for maintaining a uniform melting heat. These pots are also equipped with a steam coil for assisting in heating up the mass of material when beginning work. The complete filling of all the interstices between the bullets is greatly facilitated by the warming of the bullets before these are placed in the shell. The brass sockets are screwed home with a screw plug, and a large tap wrench. The plug is simply a stud fitted with a round nut which, upon being slackened by means of a spanner wrench, releases the stud so that it can easily be removed by hand.

Soldering the tube end into the socket

is a simple operation with a special form of copper. The sockets are now turned to gauge and the surplus solder cleaned off in small standard lathes equipped with formed tools and steady rests. The shell, as in other operations, is driven by the rear end from a special form of centering chuck. The shell now receives its final shop and government inspections, but is not painted until the results of the firing test are received.

Painting.

The painting is done on a long table equipped with rails to allow of the shells being rolled along throughout the operation. The final coat is brownish black for the body, and red for the nose, the shell being handled throughout by the rotating band which is not painted. The final act consists of a shop inspection and packing, six to a case, in which they are shipped to the arsenals of France and thence to the battlefields.

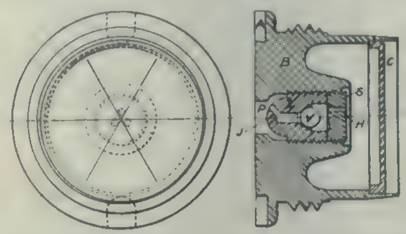
Making Brass Sockets and Plugs.

The manufacture of the brass sockets and plugs forms a sort of diversion from the main objective. These are made of a brass composition, which is such that the castings cannot be moulded in their final shape. Instead, they are simply poured in the form of slugs in cast iron moulds. As fast as the metal chills, the moulds are emptied so that the process is continuous. To obtain the desired shape and uniformity of metal, the slugs are put through a forging operation. For this purpose a heavy stamping press is employed and the dies required are very simple. In the illustration at F to the rear of the press, the oil furnace in which the slugs are brought to a red heat is shown. Three men are employed. One looks after the heating, a second places the slugs in the die, and a third operates the press and removes the finished forging.

The punch is stripped from the forging by an application of oil by means of the swab S before each stamping. The stripping from the die is accomplished by two rods extending down through the die plate from the upper bolster. The operation is very rapid and either sockets or plugs can be formed practically as fast as they can be conveniently handled. Throughout the whole process, the castings require no cleaning or pickling, the only preparation for the forging being a rough sizing cut over one face. These parts are finished rapidly in the usual way on small monitor brass lathes, and are fully inspected by Government officials before leaving the department. The office of the plug is simply to protect the thread for the fuse, and to prevent foreign materials entering the tube until the fuse is placed in position.

PERCUSSION PRIMERS FOR QUICK-FIRING CARTRIDGE CASES.

AMONG the many incidentals in connection with the manufacture of shells which are being made in Canada in quantities commensurate with the number of shells turned out are percussion primers. These are used in connection with the cartridge cases for the 18-pounder shells. Field guns are of two general types. viz.: Those using fixed ammunition and those using separate ammunition. By fixed ammunition is meant the arrangement of the shell and propellant in a single package which reduces the loading process to a single operation and thus brings the gun into the quick-firing class.



FULL-SIZE SECTION OF BRASS PERCUSSION PRIMER.

The procedure is as follows: In the leisure time of the gun crew, the powder package is placed in the cartridge case and a shell is slipped into the open end which it fits snugly until it is stopped by the rotating band. A primer is now screwed into the base of the cartridge and the unit is ready for firing.

RECRUITING FOR MUNITIONS.

A new recruiting poster has made its appearance all over London, England, calling for recruits of "any age, any measurements, any medical qualifications or disqualifications," so long as they are good mechanics or capable of doing any of the work necessary for turning out war munitions.

Men who volunteer for this service will register their names with the recruiting officers, but they will be employed directly by the armament firms, not by the Government. The recruiting officers thus become a sort of labor exchange for the firms which are producing shells, rifles and other necessaries of war. The new poster appeal is headed, "The Man the Army Wants Now," and bears a sketch of an artisan at work.

The cases may be used for from three to five shots before they become so swelled that they will not enter the gun freely. In order to use a case a second time, the old primer must be removed by a special spanner wrench and a new one put in place.

These consist of several parts, most of which are well suited for rapid production upon automatics. As shown in the accompanying cut, they consist of the body B, the screw plugs L and S, the copper ball V and the closing disc C. The complete assembly consists also of a cap inserted in the space P, and gunpowder in the space below the closing disc and two paper discs.

The body is made on turret lathes or automatic machines from drawn brass rods, and these rods must fulfil the following physical requirements under tensile test: Elastic limit, 12 tons per square inch; ultimate strength, 20 tons per square inch, and an elongation in 2 inches of 30 per cent. The rods are cast in bars about 2 inches in diameter and are reduced by successive drawing and annealing operations to 1 7-16 in. in diameter. After each annealing operation, they are pickled in a sulphuric acid solution of one to four, and then washed in water. The rods may also be formed by the extrusion process. The specified chemical composition is: Lead, 1.77 per cent.; copper, 65.93 per cent., and zinc, 32.2 per cent.

The complete body can be made at a single setting of a good automatic equipped with tap and die for the threads, and, in fact, involves a very interesting set-up. All that remains to be done is the milling on the flange for the spanner and the stamping. The screw-plugs L and S are made in a similar manner, the set-up, of course, being much simpler. The physical requirements of these parts are, however, considerably lower, namely: Elastic limit, 6 tons; ultimate strength, 12 tons; and elongation in 2 inches, 10 per cent. The plug L has three small holes drilled radially into the spherical end which faces the primer cap. The copper ball is approximately one-eighth of an inch in diameter and acts as a valve to prevent the explosion of the main charge acting backwards against the primer cap. The plug S contains three small holes drilled vertically through it, and whose purpose is to allow the flame to reach the powder in the space beyond.

The closing disc C may be either turned from the solid bar or stamped from strip brass, as it must go through a press operation anyway to produce the radial cuts; the latter method is obviously the one to adopt. After filling the large space in the body with R-FG² powder under heavy pressure, the edges are spun down over it, and the primer unit is complete. The above term refers to the fineness of the grain of the rifle powder used.

Manufacturing Shrapnel Shells in a Machine Tool Plant

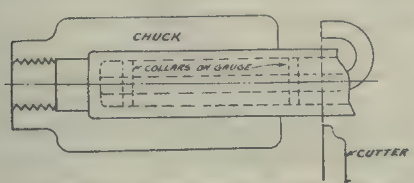
Staff Article

In this instance it will be observed that the majority of machining operations are performed on standard engine lathes equipped with suitable fixtures and attachments, and that grinding operations have been entirely dispensed with. The product output and quality is and has been such as to make procedure otherwise unnecessary for the present at least.

At this particular plant no shell forging is done, the machining and otherwise finishing features constituting, as in the majority of Canadian concerns engaged in the shell business, the contract terms.

Cutting to length and Squaring Base.

Omitting the first three operations incidental to taking the shell forgings from the car, placing them in storage,

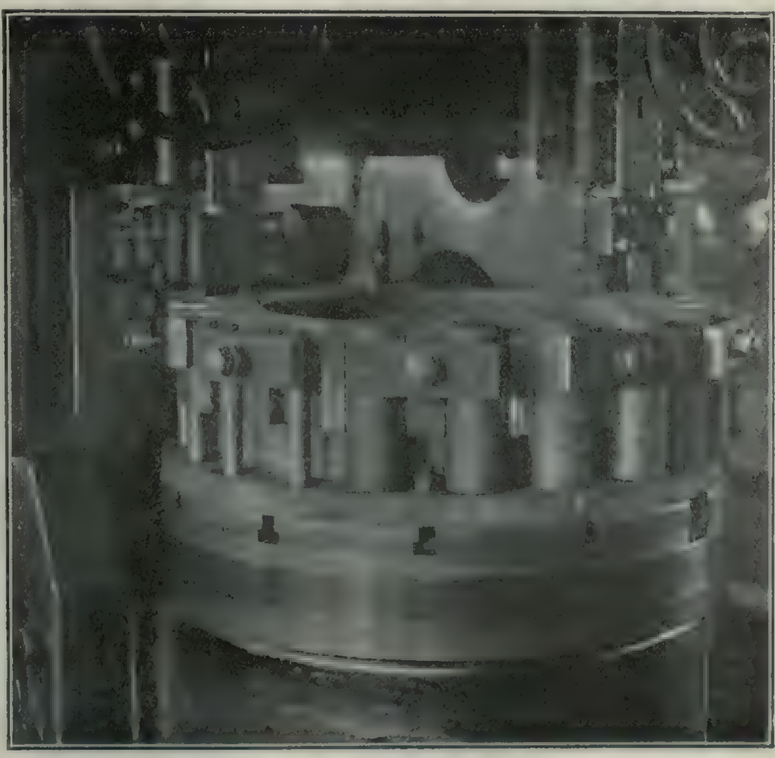


TRIMMING OPEN END TO LENGTH.

etc., we come to the fourth operation which consists of the preliminary cutting of the forging to length and squaring-up the base. The forging is chucked in an engine lathe and a gauge fitted with two collars and a hooked end is placed inside the shell. After the ragged ends have been cut off, the shells are taken to a vertical boring mill for the bases to be squared up. On the mill table is a special fixture designed to take twenty forgings with a vertical stop for each, over which the shells are placed. The forgings are clamped to the fixture, two to each clamp, and machined, the tool having previously been set to a gauge block between fixture and tool.

Body Turning and Finishing Base.

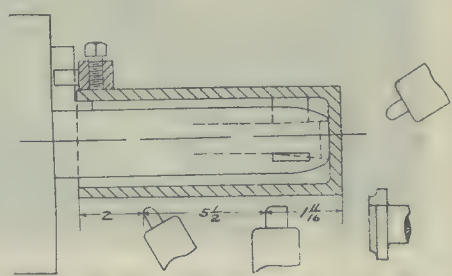
In the fifth operation, the outside of the body of the shell is turned, this being the first turning operation; the base is also finished off. This operation is done on a turn-table lathe fitted with an inside expanding arbor operated by a shaft running through the headstock spindle. The arbor is fitted with expanding jaws for truing the inside of the shell near the base. A three-jaw universal chuck grips the inside of shell which has a driving band fitted with a pin and fastened to the outside by three set screws bearing on the chuck jaws. The first tooling operation is a roughing cut on body of the shell about 7 in. from the base, the next operation being a finishing cut 1 11-16 in. from the base. In the 3rd operation the base is finished, and, with the fourth tool the corner is rounded off. The illustration shows the expanding arbor and tools in the order that they are used. The second tool is brought into play by the lever operating through a quick thread. Seven shells per hour is the capacity of the machine for the foregoing.



SQUARING SHELL FORGING BASES ON BORING MILL FIXTURE.

Machining Powder Pocket.

The 6th operation consists of boring the powder pocket and facing and boring the diaphragm seat, cutting the shell forging to length and rough turning the nose taper. The machine on which this operation is performed is an engine lathe with saddle and turret attachment. The shell forging is held in a box chuck and the end faced to length by a cutter fixed to a bar on the turret head; a stop on the slide regulates the travel of the tool. The powder pocket is roughed-out by a boring bar fitted with a suitable cutter. The turret is then turned to the next position and a similar tool makes the finishing cut to the powder pocket. The diaphragm seat is next rough bored and faced, after which a similar bar is inserted and the finishing cut made. The



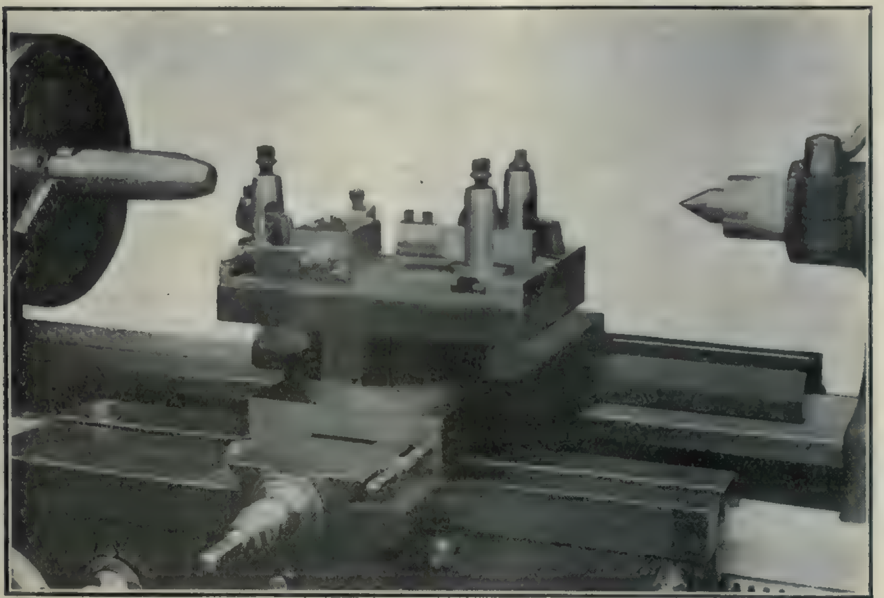
OUTSIDE BODY TURN AND FINISH BASE.

powder pocket finishing boring bar is afterwards used to clean off any ragged edges that may have been left after the diaphragm seat has been machined. All the boring bars have collars attached to act as stops. The nose is now rough turned by an ordinary tool working on a compound rest on the lathe saddle. In this operation, the machining of the inside of the shell is completed with the exception of that part of the inside of the nose which is done at a later stage.

Grooving and Waving.

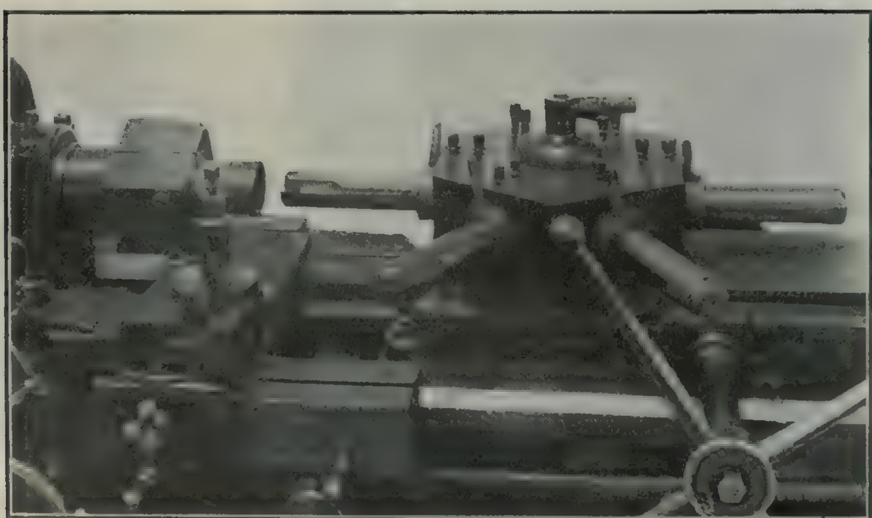
Cutting the groove and wave for the copper rifling band is done in the 7th operation. An ordinary engine lathe fitted with a special fixture for carrying the grooving, waving and under-cutting tools is used for this. It might be here stated that the purpose of the waving is to prevent the copper band from moving round when the shell is being fired. One end of the shell forging is held in a chuck which has on its face a cam, while the other end is supported by a revolving centre, cup-shaped to fit the end of the shell. It will be noticed in the illustration that the cam brackets are bolted to the saddle and

the tool holders to the lathe bed. The grooving and waving tool is held in the front holder and the two undercutting tools, left and right hand



OUTSIDE BODY TURNING AND FINISHING BASE.

are held in the back holder. At the beginning of the operation, the saddle moves towards the headstock and causes the cam on the brackets to force in gradually both the front and back tool holders. The movement takes care of the feed. The front holder containing the grooving and waving cutter is held up against the cam on chuck by the spring on the right. The cam imparts an oscillating motion and gives a wave to the ribs. At the same time, the back tool holders containing the undercutting tools are being forced in by the two cams



OUTSIDE NOSE TURNING, BORING DIAPHRAGM AND POWDER CUP SEATS. AND FACING TO LENGTH.

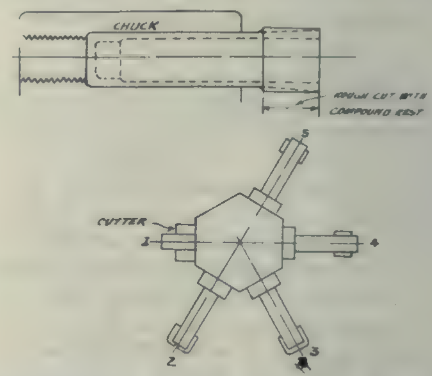
in a diagonal direction which is obtained by the holders running on diagonal guides on the slide. A stop in the centre of the fixture regulates the depth of cut for all the tools. The capacity of the machine for this operation is ten per hour. This is the last operation previous to the heat treating.

Heat Treating.

The next operation is perhaps the most important of all as the shell must have a certain degree of hardness within a small range before being accepted by the government. The tensile strength of the shell after heat treatment must be approximately 80,000 pounds per square inch, with a small allowance above that figure. It follows that great care must be exercised during this operation to obtain satisfactory results. The shells are first placed in a muffle gas furnace at a temperature of 1,560 degrees F. for about 20 minutes, and are then quenched in an oil bath. This process hardens the shell. The oil is cooled by air being passed through the bath. The shells are next tempered by being placed in a muffle furnace for about 12 minutes at a temperature of 830 degrees F. They are then taken out and allowed to cool gradually in the air. Each furnace is equipped with a pyrometer, and the oil tank with a thermometer.

Scleroscope Test.

The shells now undergo the scleroscope test for hardness which must be around 45, a slight variation above or below being allowed. A narrow strip round the body of the shell is first polished, after which it is taken to the scleroscope. This apparatus consists of a vertical glass tube with an arrangement at the top for drawing up the steel hammer in the tube and a catch for holding the hammer until released. This part of the apparatus is operated by a rubber air bulb. At the back of the tube is a scale on which are figures which bear relation to the tensile strength of certain metals. The shell is placed in a grooved block under the scleroscope and the diamond pointed steel hammer allowed to drop on the polished part of shell. The hammer rebounds and the figure at which it stops is noted by the operator. This is repeated several times, the shell being moved round each time.



BORING DIAPHRAGM AND POWDER POCKET SEATS AND FACING TO LENGTH.

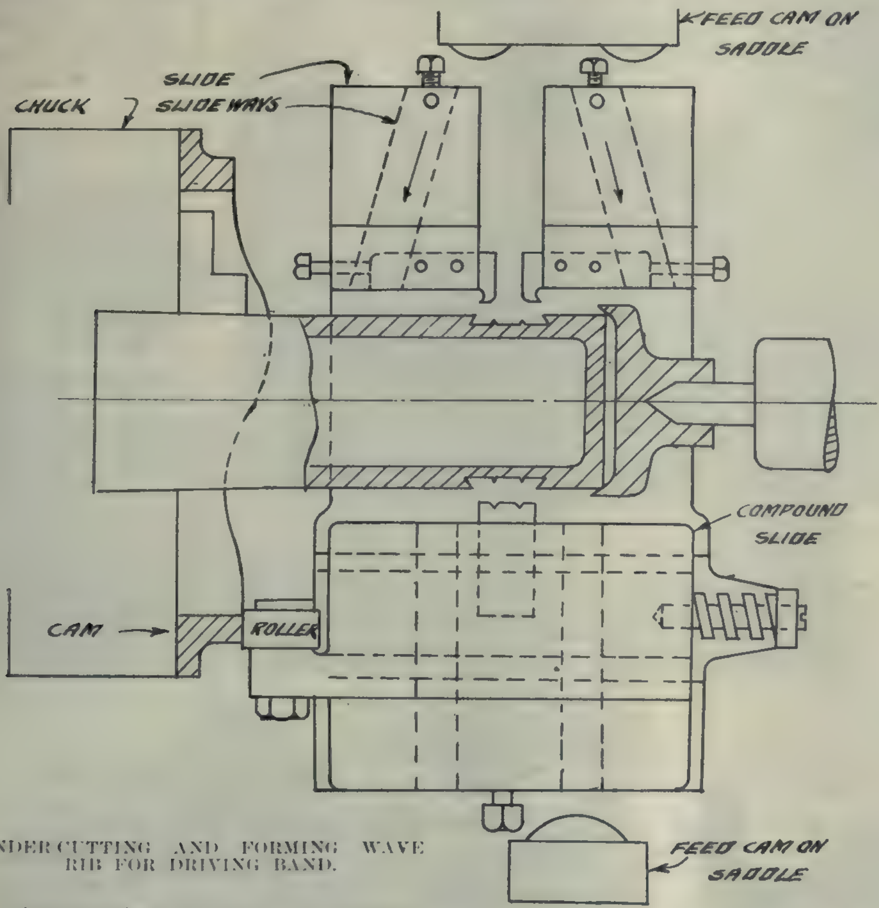
Preparing Test Piece.

The 9th operation consists of making up the shells in tested batches of series of 120, one being taken out to have sections cut for the tensile test by a government inspector. The rest of the batch are held up until the inspector's report is received, unless unduly delayed. Three test pieces are prepared and to obtain these, part of the shell is milled flat and the test pieces cut out and worked up to a certain sectional area.

Nosing Operation.

Up to this stage the shell is practically straight, and, before any more machining can be done, the open end must be partially closed up. This operation, which is the 10th is called nosing or heading. The open end of the shell, for about three or four inches, is held in a

bath of molten lead until sufficiently heated. The diaphragm which is larger

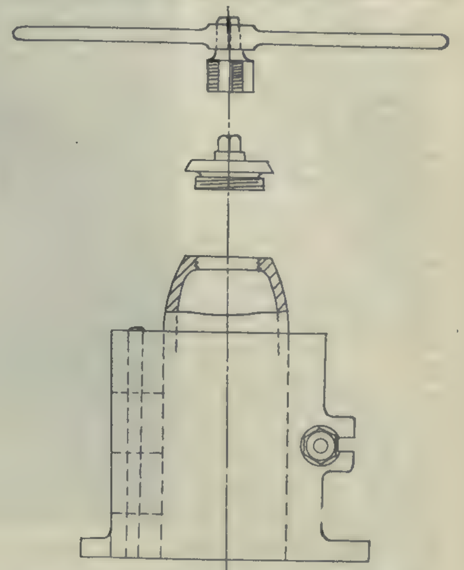


UNDERCUTTING AND FORMING WAVE RIB FOR DRIVING BAND.

in diameter than the nose is then dropped in and the shell placed nose up in a press, after which a cone-shaped die descends and closes in the nose to the required shape and size. The shell is next taken out and the nose dipped in powdered lime which has the effect of softening the metal. In the foregoing forty shells per hour can be treated.

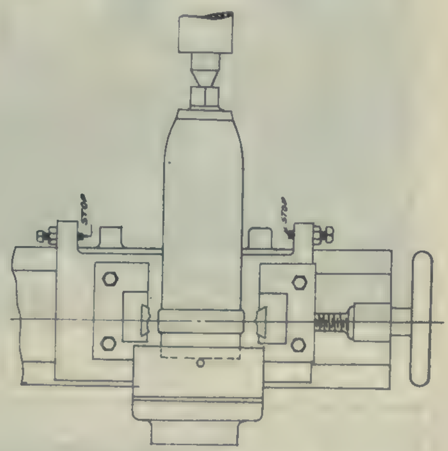
Turning and Threading Nose.

The shell is now ready for the 11th operation which consists of turning and threading the nose. This is performed on an engine lathe with a turret on saddle slide in place of the ordinary tool holder. The turret is moved round by hand and locked by lever shown in front. The



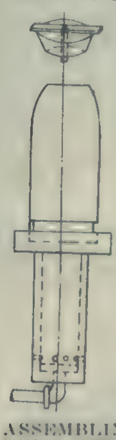
HAND TAPPING AND SCREWING THREADED CENTRES IN NOSE AND REMOVING CENTRES.

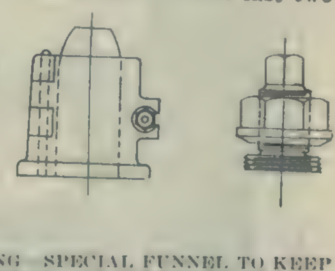
shell is held in a box chuck and is first faced to length by cutter on bar No. 1,



COPPER DRIVING BAND TURNING.

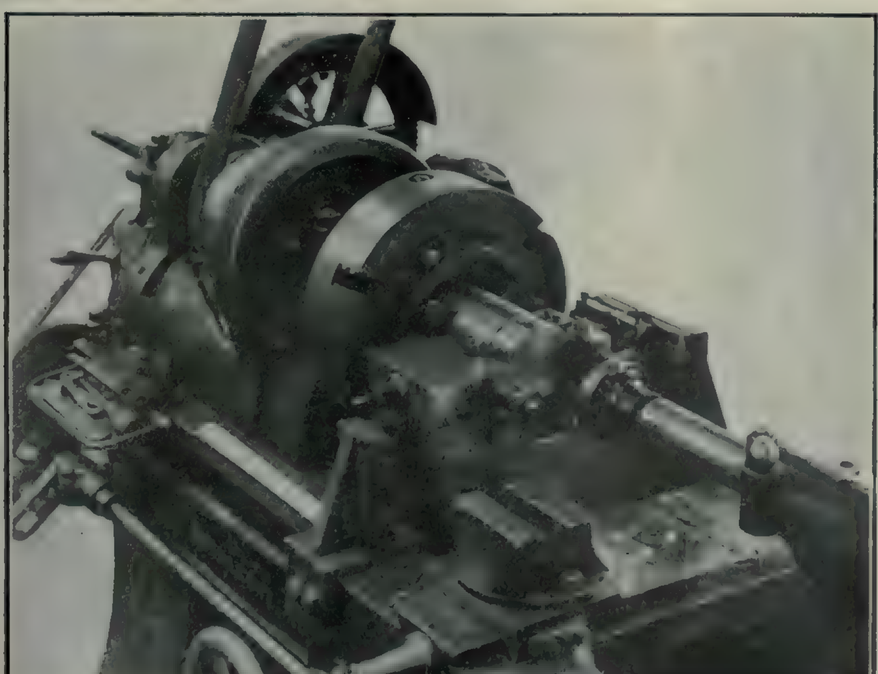
a swinging saddle stop being used. The turret is then swung round and bar No. 2 is placed in position for rough boring and chamfering the inside of nose. Bar No. 3 carries a floating reamer which finishes the nose bore. For the last two





ASSEMBLING SPECIAL FUNNEL TO KEEP TUBE CENTRAL, AIR VIBRATOR, HINGED CHUCK, BRASS SOCKET AND THREADED PLUG.

tooling operations, a stop on the slide regulates the travel of saddle. The in-



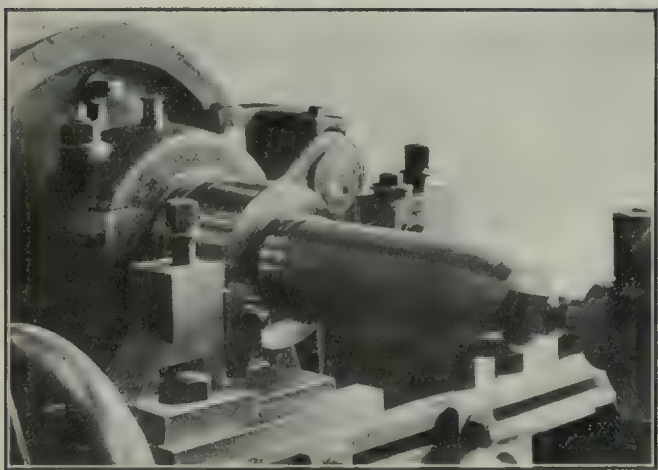
DRIVING BAND GROOVING, UNDER CUTTING AND FORMING WAVE RIBS.

side of nose is next bored by cutter on bar No. 4. To obtain the correct outline, a cam is fixed to a bracket secured to the bed between the slides, and projecting from the base of turret is a bracket carrying a roller. When the cutter is in operation, the roller follows the face No. 1 of the cam and imparts the outline to the cutter. Bar No. 5 taps the bore and No. 6 rough turns the outside of the nose; in this case, face No. 2 of cam gives the outline. The saddle during the entire operation is operated by hand. The lathe capacity for this operation is seven per hour.

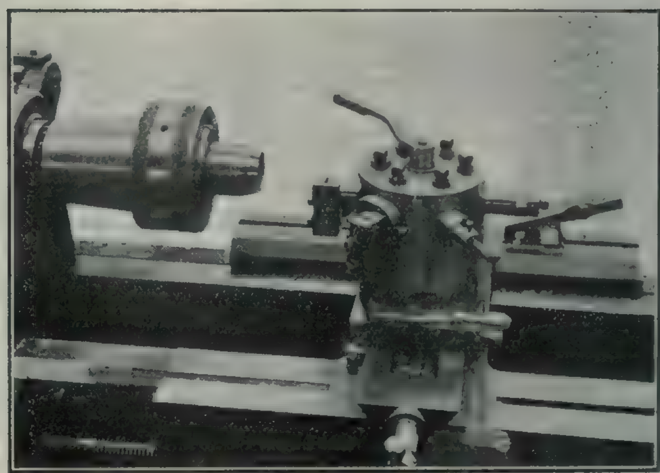
HEAT TREATING HEATING FOR HEADING.

Fitting Threaded Centre and Rough Turning Body.

This last operation completes the machining of the inside of shell, but the outside has yet to be finished. In the 12th operation the shell is held in a hinged chuck and the threaded part of nose is hand-tapped. A

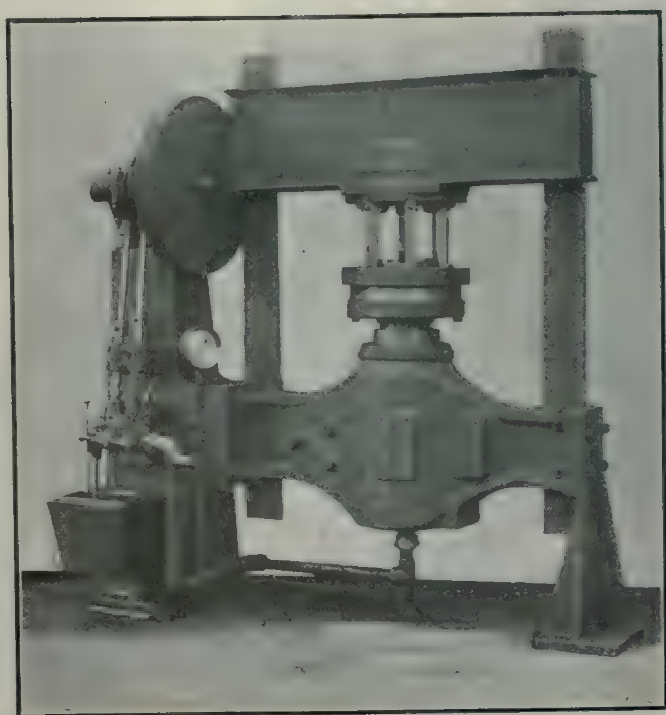


COPPER DRIVING BAND TURNING.



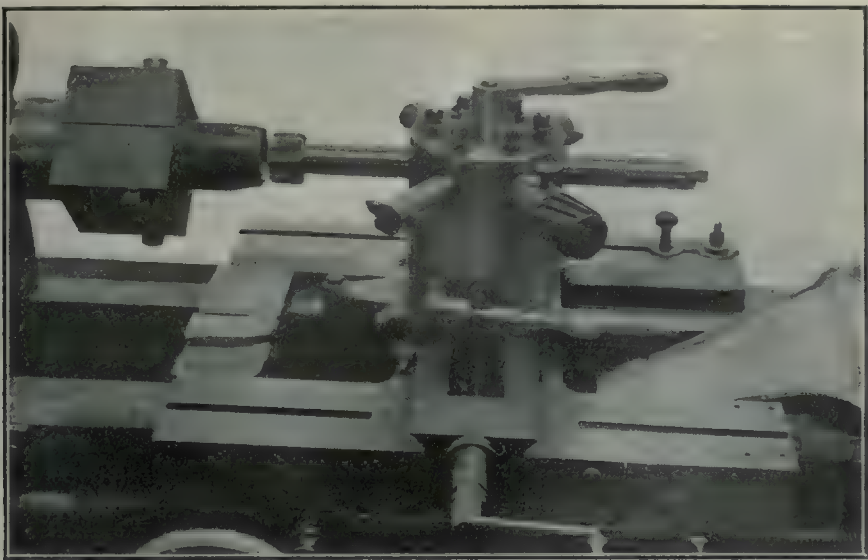
SOCKET FINISHING.

TESTING SHELLS FOR HARDNESS.



PRESSING ON DRIVING BAND.

threaded centre is then screwed in the nose for holding it in the lathe at the next operation. At the 13th operation, which is performed on an engine lathe, the shell is held in a collet chuck and

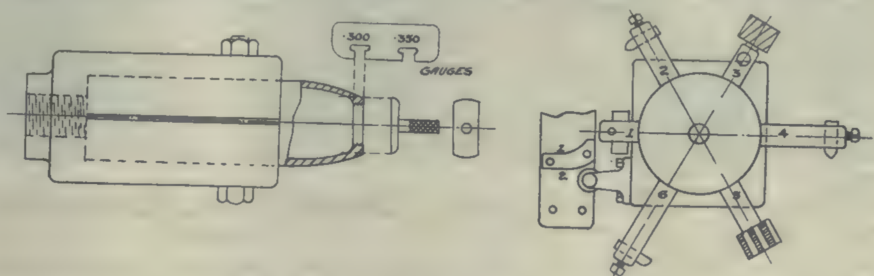


HEAD TURNING AND THREADING.

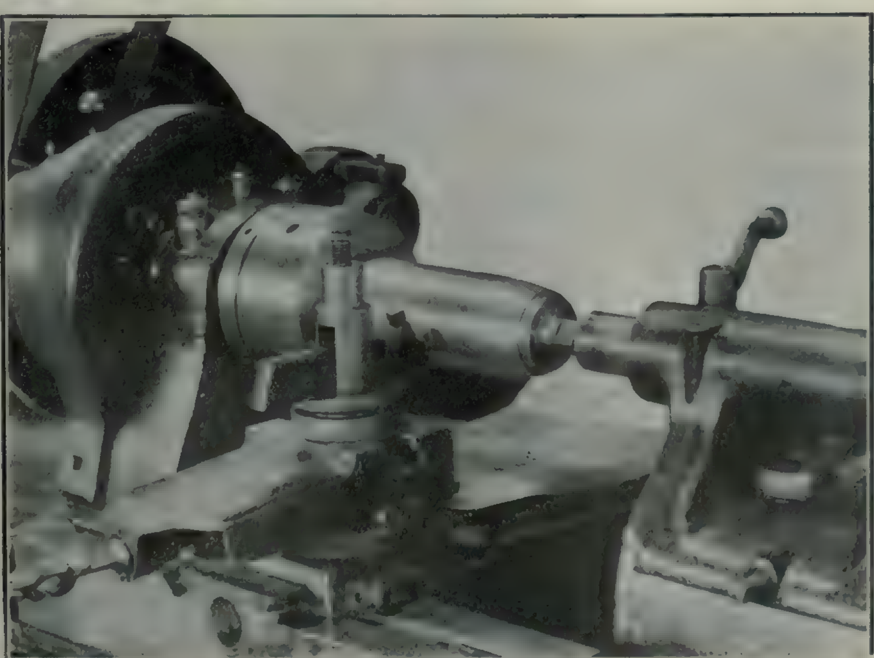
rough-turned from the copper band recess to the curve on the nose.

Finishing Cut on Body.

In the 14th operation, the finishing cut is made from the band recess to end of nose. This is performed on an engine lathe equipped with a special cam fixture for giving the correct direction for the travel of the tool. In addition to the curve of the nose, the increased diameter of the shell at the shoulder has to be taken care of, the shell being of larger diameter at the shoulder than on the body. The cam is situated at the back of lathe above the bed, and at the back of and attached to the slide is a bracket which extends over the cam and has a roller attached which engages with the cam. Two springs held the roller against the cam and give the required direction to the tool through the slide. In this operation one man can handle two machines with an output of eight per hour.



SHELL HEAD TURNING AND THREADING.



ROUGH BODY FINISHING.

Inspection and Marking.

The next three operations consist of removing any scale that may be on the inside of shell, washing the shell in boiling caustic soda to remove grease and dirt, and finally government inspection. The shells are very carefully inspected and weighed, high and low limit gauges being used. They are afterwards taken to the marking machine, but, before being put into same, wedges are inserted in the shell to prevent any possibility of its being distorted by the pressure of the die.

Pressing on Rifling Band.

The next operation consists of pressing on the rifling band in the groove prepared for it. This is done on a vertical hydraulic press fitted with a special attachment holding six wedges. The press is capable of exerting a pressure of 25 tons. The copper ring is slipped on the shell and put in position, the shell being then placed in the press nose end up, and the pressure applied at six points through the wedges. The copper band is now secure and ready for turning up.

Turning Rifling Band.

For turning the copper rifling band, an engine lathe is used. The shell is held in a short collett chuck and is supported at the tail stock end by a threaded centre. On the cross slide are two tool holders with cutters of suitable shape. A roughing cut is first made with the back tool and a finishing cut with the front tool. A stop on the slide is adjusted to the correct diameter for the band. The output for this operation is fifteen per hour.

Assembling and Filling Shells.

The shells are now ready for assembling and filling which is the 21st operation. The tin powder cup is first slipped in past the diaphragm into the powder pocket and the brass fuse tube screwed into the diaphragm. The shell is then taken to an air-jarring machine and filled by a special funnel with bullets which have been previously weighed. The jarring helps the bullets to pack close together. Hot resin is then poured in and a brass socket screwed in the nose of shell by means of a threaded plug, the shell during the latter process being held in a hinged chuck. The shell is weighed after the bullets and also after the resin

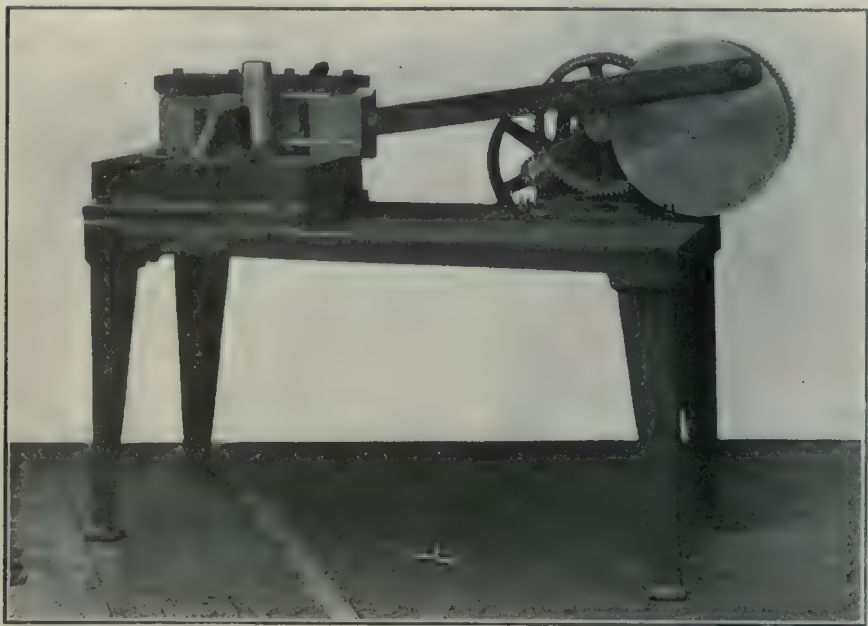
has been put in and the necessary adjustment made.

Socket Finishing.

In the 22nd operation, the brass tube is soldered to the socket. The next operation consists of finishing the socket, this being performed on an engine lathe with turret attachment, with the shell held in a special chuck. The fuse tube is first cut off and the inside of socket cleaned up. The end of socket is then finished off and the outside of socket turned to conform to the radius of shell nose. This completes all machining operations.

Final Weighing and Painting.

The brass socket is now hand tapped to gauge and the brass plug screwed into it. The shell is then cleaned and finally weighed. The weight must be very accurate, not exceeding four drams either way. After being inspected by a government inspector and stamped, the shell is given two coats of grey paint on the body, the nose end being painted a bright red. Shipment is made in special boxes holding six shells each.



BERTRAM SHELL MARKING MACHINE.

SHRAPNEL SHELL CARTRIRGE CASES.

THE development of a shrapnel shell represents a vast amount of experimenting and study, but the shell itself is not comparable with the wonderful processes and tools which are employed in its manufacture. The interesting phases of shrapnel manufacture are the formation of the brass case, the forging of the steel shell and the finishing of the various shell and fuse parts to the degree of accuracy required. The production of a brass case 11½ inches long, 3 3-5 inches diameter (the British 18-pounder) requires 17 different operations.

It is formed from a flat circular blank 6¼ inches in diameter and ⅜ of an inch thick. This is first drawn into a shallow cup shape, and is then gradually elongated by being forced through steel dies which are progressively smaller in diameter. These drawing operations are so controlled that only the sides of the case are made thinner, the bottom retaining practically the original thickness to insure the necessary strength. After a smooth seamless case is drawn by the method referred to, the bottom is turned true and a central hole bored out and threaded to receive the primer or cap for exploding the propelling charge. As these brass cases, as well as those for other kinds of ammunition, contain about 65 per cent. of copper, the importance of this metal in modern warfare is apparent. This explains why the cost of copper has increased over 200 per cent. in Germany since the beginning of the war.

The framing of battleships is usually on the longitudinal system, the transverse framing being worked intercostally.

* * *

Every day at 5 p.m. in war time, the whole of the fighting mechanism of a British warship is tested and got ready for the night.

ASSEMBLING POWDER CUP, FUSE TUBE, BULLETS, SOCKET AND RESIN.

Shell Production in a Locomotive Engineering Works

Staff Article.

The equipment of our up-to-date locomotive building establishments compares perhaps more than favorably with most mechanical engineering institutions in their adaptability and general readiness to extend the scope of their operations, hence small wonder is it that the illustrations and description which follow will be found to show that as regards shrapnel shell production, this chosen plant is well to the front in its every feature requirement.

A CONSIDERABLE proportion of metal working plants in Canada have undertaken the manufacture of shrapnel shells by means of specially manufactured machines and tools. Of course, for some of the simpler operations, standard machines have also been employed to advantage. Many other firms, however, have either found it impossible to purchase machine tools for this particular work, or have deemed it the wiser plan, in view of the uncertain length of the time that the demand for shells would continue, to tool up their standard machines and use them wholly to the best possible advantage. Among the latter is the Locomotive Company, whose shell department this article features.

In a locomotive shop the product cannot be termed standardized. This is quite easily understood, because it is not often that the same type of locomotive is specified on repeat orders. The continued demand for more tractive power and higher efficiencies have caused the design of a locomotive to be continually changed. Thus, usually an engine has to be laid-out on the drafting boards, from the drivers upward, to boiler, superheater, fire box, valve gear, cylinders and frame. Thus the men employed in the manufacture of locomotives are wide awake men and keenly alive to many practices and principles of which the average shop man, with a more or less standardized product, is blissfully ignorant.

This firm, when it decided to tool up its standard machines or special machines used in locomotive work, knew well that its engineering department was able to do this to better advantage than most shops. Thus, on visiting the shop to-day with all the machines engaged on their various operations and noticing how perfectly the tools perform and the speed with which the work is accomplished, one cannot but feel that the superintendant who designed and super-

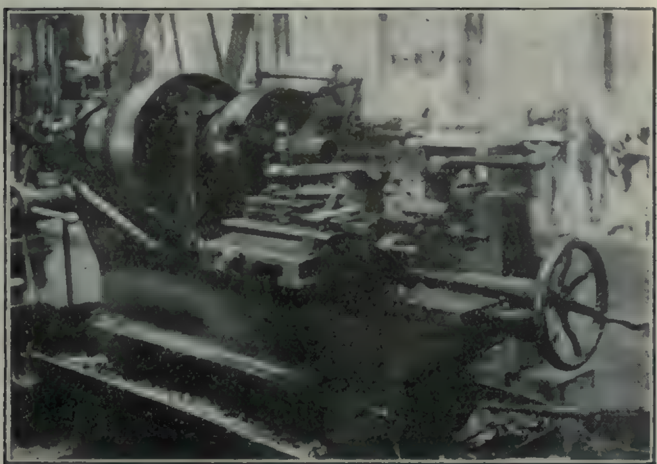


FIG. 1. POTTER & JOHNSTON CUTTING-OFF MACHINE CUTTING OFF OPEN END OF 18-POUNDER SHELLS.

FIG. 2. NEWTON ROD MILLER MILLING 18-PR. SHELL BASES WITH SPECIAL JIG BOLTED TO TABLE.

FIG. 3. WHITCOMB LATHE WITH SPECIAL EXPANDING 18-PR. SHELL CHUCK AND SPECIAL TURRET TOOL POST CARRYING TOOLS FOR ROUGH OPERATIONS.

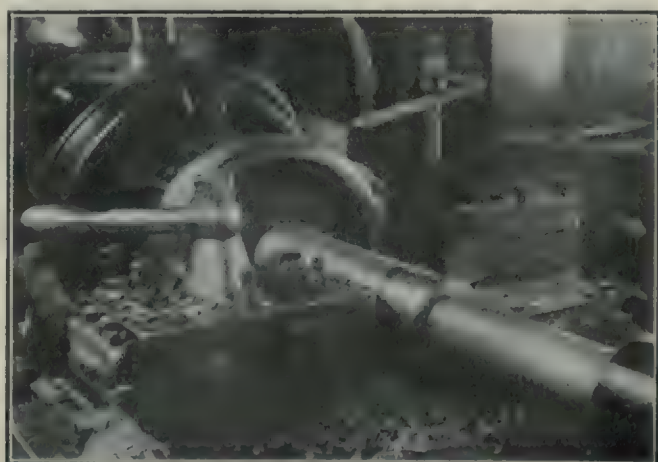


FIG. 3. WHITCOMB LATHE WITH SPECIAL EXPANDING 18-PR. SHELL CHUCK AND SPECIAL TURRET TOOL POST CARRYING TOOLS FOR ROUGH OPERATION.

FIG. 5. ACME TURRET LATHE TOOLED FOR BORING 18-POUNDER SHELLS.

FIG. 7. CAN.-HOSKINS GAS FURNACE WITH SPECIAL PRE-HEATING MUFFLE. OIL QUENCHING TANK AT LEFT.

vised the outfit is deserving of the greatest praise.

Several new machine tools, including two flat turret lathes and several small engine lathes, have been purchased and are being used in the shell department. These purchases had been contemplated, however, before the question of shell manufacture had been taken up, as a new machine shop had been erected and new tools were to be purchased for installation. It may, therefore, be said that the only equipment purchased by this company expressly for the manufacture of shrapnel shells was the collapsible tap used in finishing the inside of the nose. In performing several operations, these shop-made tools have established some remarkable time records which have, we believe, yet to be challenged.

The shop is divided into two departments which are shown in Figs. 18 and 19, and give a good idea as to the course of the shell in process of manufacture.

Marking of Forgings, Etc.

The point of reference from which all preliminary measurements are taken for the first roughing cuts on a shrapnel shell, seems to be the bottom of the powder pocket of the forging, which is, of course, the logical place from which to take these measurements. The shell is placed over the fixture A in Fig. 20. This fixture is made of machinery steel and stands upon a plate, the surface of which has been finished. The top of this steel fixture comes in contact with the bottom of the powder pocket, while the increased diameter of the lower portion of the fixture, being only slightly smaller than the inside of the forging, guides it, and keeps it vertical. The hollow steel sleeve B is then slid over the forging, this steel sleeve being only slightly larger than the latter in its inside diameter. The top and bottom edges of this sleeve are finished, as also is the slot shown. The line to which the back end of the shell is to be rough faced is marked in chalk from the top edge of the sleeve, and the line at which the open end of the shell is to cut off is marked from the lower edge of the slot. The shell is now removed to the cutting-off machine,

FIG. 6. BULLARD VERTICAL BORING MILL EQUIPPED WITH TURRET FOR BORING 18-POUNDER SHELLS.

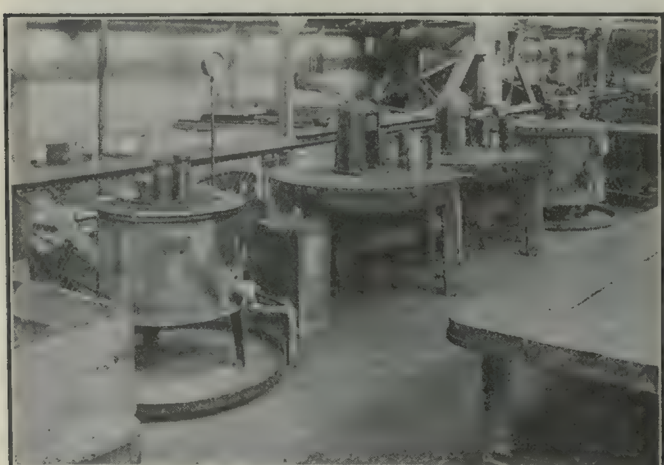


FIG. 8. CANADIAN-HOSKINS AND CHICAGO FLEXIBLE SHAFT CO. LEAD POTS AND NOSING PRESSES.

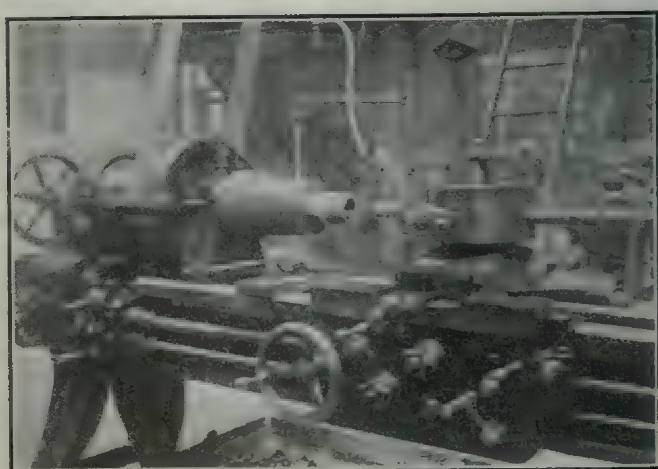


FIG. 9. AMERICAN LATHE WITH TURRET FOR FINISHING INSIDE OF NOSE, 18-POUNDER SHELL.

the chalk lines being clearly centre-punched.

Fig. 1 shows a Potter & Johnston machine equipped with a Skinner universal chuck. A single parting tool is used to cut off the ragged end, and approaches the work from the far side. This operation is also carried out in a similar manner on a Bertram cutting-off machine and also on a Herbert (Coventry, Eng.) heavy duty turret lathe having a universal chuck which forms a part of the regular equipment of the lathe. On these machines the tools approach the work from the near side of the machine. The number of shells marked off by one man in a day of 11½ hours is 808, and the number of shells that one man on one cutting-off machine has handled in an 11½-hour shift is 285. Water lubricant is used on the tools.

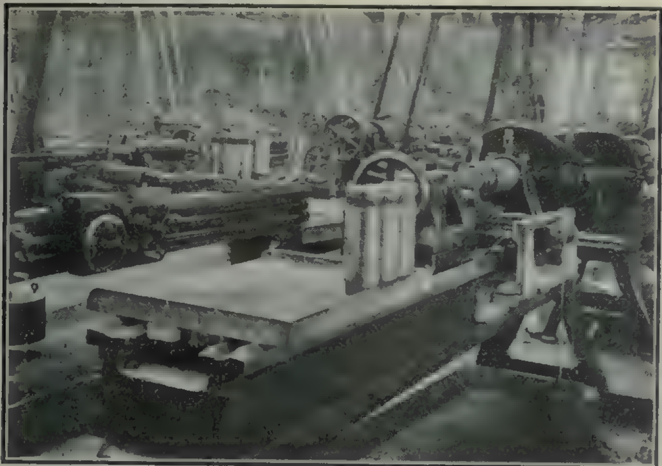


FIG. 10. C.M.C. ENGINE LATHE AND AMERICAN ENGINE LATHE FITTED FOR FINISH TURNING SHELLS.

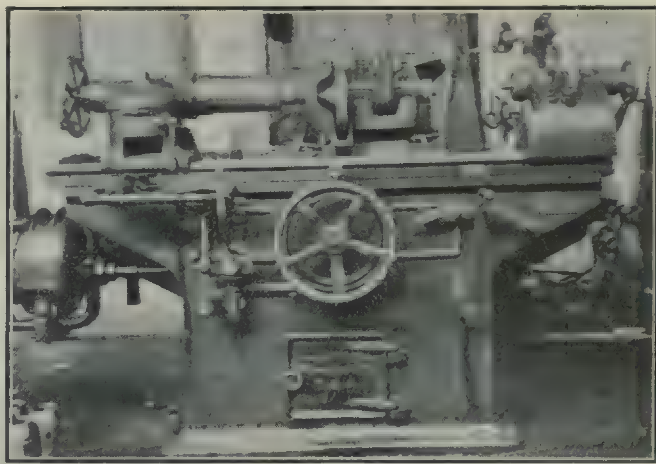


FIG. 11. LANDIS GRINDER FOR FINISHING AND CLEANING UP BASE OF SHELLS.

Cutting Off the Back Ends.

In this operation an instance of how some of the large machine tools used in locomotive work have been pressed into service is shown. Fig. 2 shows a large Newton rod miller to which has been fitted two special jigs to which the shells are clamped after the ragged ends have been cut off. The shells are staggered in the jigs, as can be seen. One clamp or strap, the inside of which has been formed to fit the curves of shells, serves to hold two shells. One hundred and sixteen shells can be clamped in the two jigs at once in four rows of 29 each. Two milling tools are used ,each having a 10-inch face. The diameter of the cutters is 8 inches. The teeth are inserted and thus it is a simple problem to keep the machine supplied with tools to ensure its operating continuously if required.

The jigs or clamping blocks are made of cast iron. The cutting can be made practically continuous because, as the finished shells pass under the head, they are removed and new ones placed in the jigs, while the machine is still in operation. Thus, when the table arrives at the end of its travel, the tools are raised a little from the work, and the table is quickly run back to commence another cutting stroke, and shells are already clamped in the jigs to receive the milling cutters. This machine has milled 796 shells in 11½ hours. Another machine that has been fitted up to face of the back ends of the shells is a 60-inch vertical Bertram boring mill. A circular cast iron clamping block is bolted to the table of the machine and the ends of the shells are faced. However, the Newton rod miller is capable of machining all the shells required at present and the boring mill has been used rather as a stand-by for machining small lots.

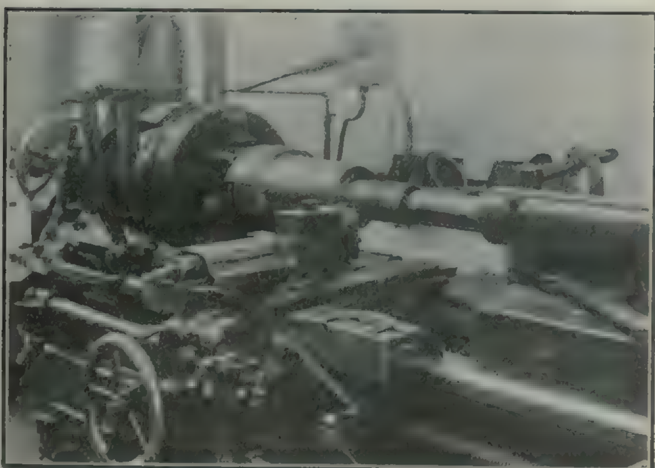


FIG. 12. C.M.C. ENGINE LATHE WITH SPECIAL COLLET CHUCK TURNING COPPER BANDS.

FIG. 14. GENERAL VIEW OF THE ASSEMBLING DEPARTMENT.

Rough Turning Operations.

The rough turning is done mostly on hollow spindle engine lathes. There are five Whitcomb engine lathes and one Canada Machinery Corporation engine lathe used in this work. The shell is held in a special expanding chuck made in the shop. This chuck is shown in Fig. 21. The milled jaws on the outer end of the shell act as a stop and locator. There are three expanding jaws in the inner end which are forced out by the taper on the central rod. This rod passes through the hollow spindle of the lathe and a handwheel is keyed to the end of it. This handwheel is used to open and close the jaws.

A groove is turned in the outside of the jaws in which a circular ring of spring steel is placed. The ring is split and is expanded when the jaws open. When the tapered shank of the rod is withdrawn this spring is sufficiently strong to cause the jaws to draw away from the work and keep pressing against the tapered shank.

The lathes are all fitted with turret tool posts as will be seen in Fig. 3. These tool posts are placed on the far side of the carriage. The first tool rough turns the body of the shell up to about two inches of the open end. Then the tool is re-set, taking a lighter cut and just truing up end of the shell. The shoulder is next removed and a rough taper formed by the hand manipulation of the cross slide. This is all done with one tool. The tool post is now swung around a quarter of a turn, a finish turning tool is placed in position, and the shell is finish turned up about two inches from the back end. The tool post is swung around another quarter turn and the tool for facing the end of the shell brought into position. After the end of the shell has been faced, the turret is again swung a quarter of a turn and a radius of 1-10 of an inch is formed on the corner of the shell. This completes the series of operations on these rough turning lathes. Snap gauges are provided the operators to caliper their work. A little gauge is also used to test the profile of the radius on the end of the shell. Soda water cutting lubricant is used on all machines engaged in rough turning.

The average production of one man on one machine is 90 shells in one shift of $11\frac{1}{2}$ hours, which is remarkably good work.

Cutting Recess and Forming Wave Lines.

Four lathes are fitted up with tools to accomplish this work, namely, a Lodge & Shipley engine lathe and three Canada Machinery Corporation engine lathes. A fifth engine lathe, a London Machine Tool Co. product, is also equipped to do this work, but is not in use constantly on this operation. Fig. 4 shows the Canada Machinery Corporation lathe with a shell ready to have the recess cut. To the face plate of the lathe is clamped a steel three-point cam, as illustrated in Fig. 22. The shell is placed in the central casting against a stop, and it is securely held there and driven by the tightening of the set screws. The other end of the shell is supported by a revolving centre mounted on the tail stock spindle of the machine. Throughout this entire operation the carriage is locked to the ways of the lathe.

FIG. 13. RESIN POT WITH WOODEN HOPPER ABOVE FOR SHOT.

On the far side of the cross slide is bolted a tool holder, which carries a tool that when fed into the work cuts the groove roughly to its width. The cutting edge of the tool is flat, and this tool cuts the groove till the bottom diameter is 1-64 of an inch greater than the finish diameter over the wave lines. The tool is then withdrawn. On the near side of the cross slide, a turret tool holder is bolted; this carries the undercutting tools and the wave-forming tool. Fig. 23 shows this turret tool holder in detail. A lever on the squared end of the cam, shaft A, is used to actuate the cam, by means of which the undercutting tools are fed into the work. These two tools cut the recess to its finish width, and they also cut the groove at its edges to its finished depth. The cam is so designed that the tools have cut to the finish depth and width just as the highest point of the cam is reached. The guides of the little tools are arranged at an angle to the work and, being fed into the work at this angle, they accomplish the undercutting. The guides are, of course, also so arranged that the exact finished width of the recess is cut also. A special spring of flat steel causes the tools to withdraw from the work when the lever is pulled back.

The tool post is now swung around and the cross slide is run in, until the roller C is registered against the three-point face cam. An oscillating lateral motion of the wave tool holder is thus communicated to the tool by the pressing of the roller against the face cam, but this motion is not yet wholly controlled by the cam and roller. This is due to the little stop B, which holds the little oscillating tool holder in its mid-position. The tendency of this tool holder is to move toward the head stock of the lathe, because of the flat steel spring D, and it is prevented from moving past its mid-position by the stop B; thus the roller is able to pass over to the face of the cam without difficulty, as the cross slide is fed in toward the

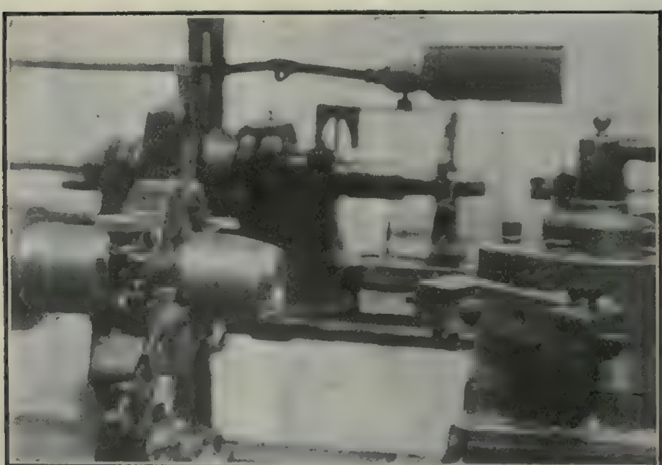


FIG. 15. WARNER & SWASEY TURRET LATHE TOOLED UP FOR FINISHING BRASS SOCKETS.

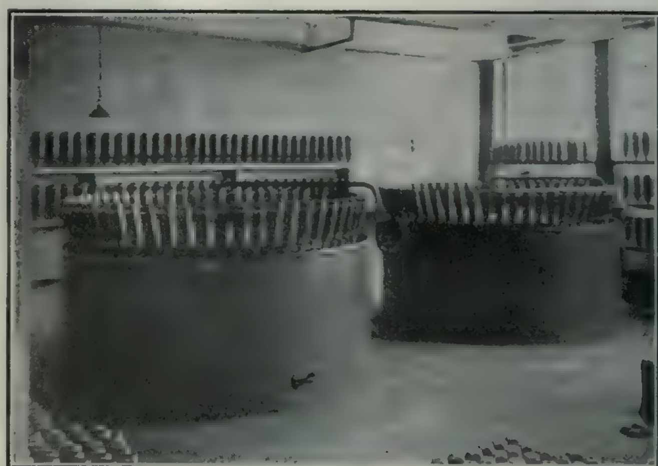


FIG. 17. TWO PAINTING MACHINES OF CANADIAN LOCOMOTIVE CO. MAKE.

centre of the carriage. The high points of the cam still touch the roller; thus the pressure against the stop B is released at certain positions of the cam, and the stop B is easily lifted out of its slot. The spring D now causes the roller to follow closely the contour of the cam, thus the tool is oscillated.

The tool is fed into the work, and the specially ground cutting edge forms the wave lines, in conjunction with the lateral motion imparted to the tool by the cam. The width of this tool is sufficiently great to clean up the bottom of the groove and when it is fed into the finished depth the recess is completed. Water lubricant is used on all machines engaged in this operation. The production of one man on one machine is 125 shells in a day of $11\frac{1}{2}$ hours. Fig. 24 gives a view of the cross slide used to carry the turret tool holders.

Snap gauges are used to test the diameter of the bottom of the groove, while a little steel limit gauge is used to check up the width of the recess. This limit gauge is a piece of thin flat tool steel, one end of which is ground to the large limit, and the other end to the small limit, of the width of the groove.

Boring Powder Pocket and Diaphragm Seat.

The boring of the powder pockets and the diaphragm seats is accomplished largely on turret lathes. There are two Acme and one Jones & Lamson flat turret lathes, all similarly tooled. One of the Acme machines is shown in Fig. 5. The shell is chucked in one of the collet chucks made in the plant. The boring bars are very rigidly clamped to the turret, one of them extending right across the turret and being supported by two clamps on the latter. Each end extension is a boring bar and carries a boring tool. The third and fourth boring bars are separate, but they pass through the single clamp on the turret, and the extensions are mortized into the larger bar extending across same. The rough boring of the diaphragm seat has been dispensed with, only a finish cutter being used. Thus only three boring tools, and hence three boring bars are being employed. Soda water is used on all cutting operations, being conveyed to the tools through ducts in the boring bars.

The first tool to be fed into the work is a gashed roughing cutter for roughing out the powder pocket. The tool is fed into the work until a stop collar on the boring bar comes against the end of the shell. The next cutter is the finish cutter for the powder socket. On this boring bar is carried a cutter which faces the end of the nose of the shell. The third cutter is the finish diaphragm cutter, which is fed into the work till a stop collar on the boring bar comes up against the nose of the shell. The shell is now taken out, all chips and any of the soda water cutting lubricant removed, and the depth between the diaphragm seat and the bottom of the powder pocket, also the thickness of the metal in the bottom of the shell are tested with tools shown in Fig. 25. The best production of one man on one machine in a day of $11\frac{1}{2}$ hours is 186 shells.

Two vertical Bullard boring mills, equipped with turrets, are used for this same purpose. Fig. 6 shows one of these boring mills so equipped. A collet chuck, shown in Fig. 26, is bolted to the table of the mill. Four boring bars radiate from the turret, and are used in this operation. The first boring bar put down into the work is that carrying the cutter for rough boring the powder pocket. Unlike the tools carried in the horizontal boring bars used in the turret lathes on this work, this tool has only a single cutting edge, this type being used to increase the chip clearance room, as all chips will naturally fall, under gravity, to the point at which the tool is cutting; while in the turret lathes a steady stream of soda water through ducts in the boring bars tends to wash the chips away from the cutting edge of the tool. This single cutting edge tool is not gashed.

Previous to putting the tool down into the work, a supply of soda water is

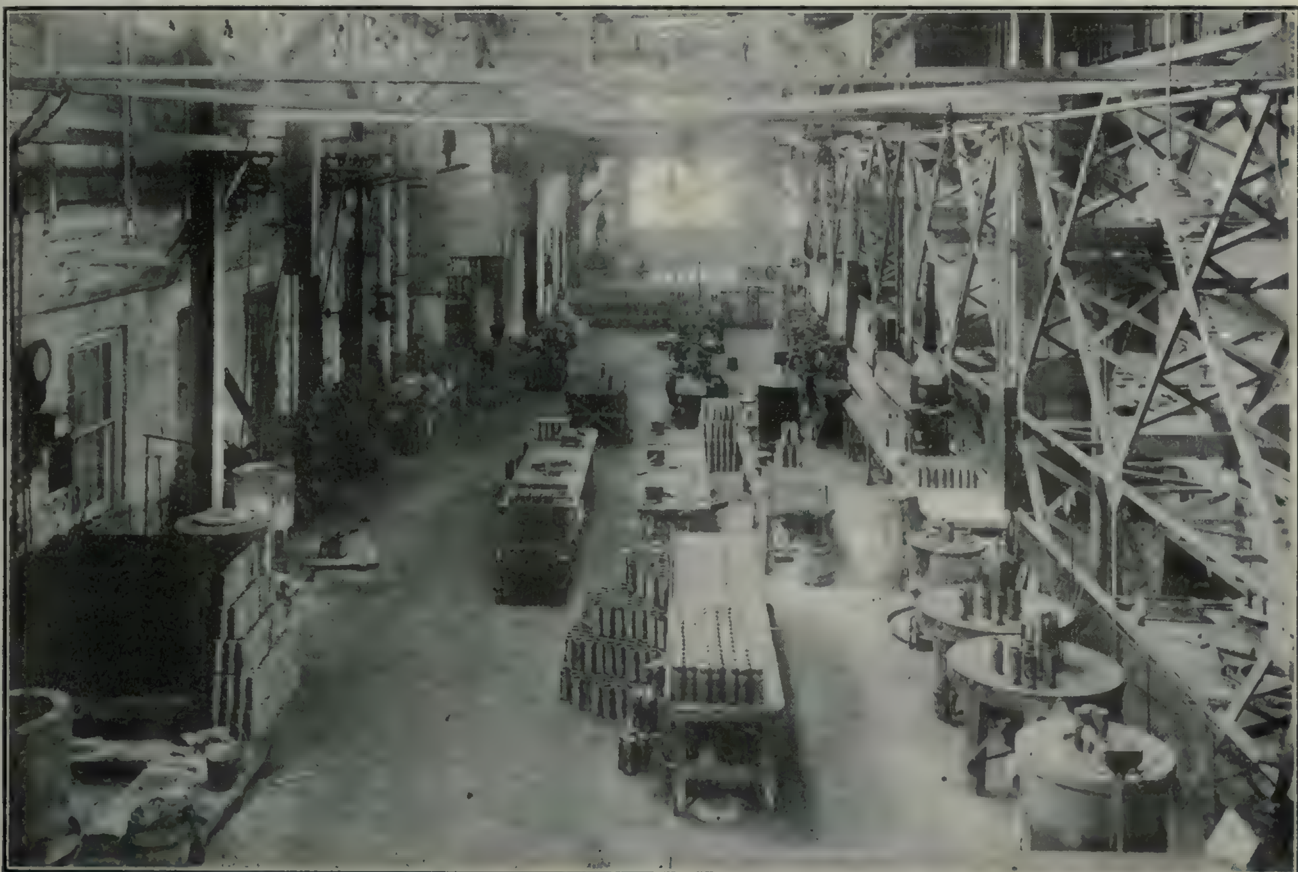


FIG. 16 GENERAL VIEW OF HEAT TREATMENT, ASSEMBLING, AND BRASS AND COPPER DEPARTMENTS.

put in the shell with a dipper or squirt gun, and a leather washer is slipped over the shell and down on to the chuck. This washer fits the shell tightly and prevents all chips from getting down into the collet slots of the chuck. A collar on the boring bar acts as a stop when this collar comes up against the nose of the shell. The tool is now withdrawn, and next the roughing diaphragm cutter is put down into the shell. This tool is taken out and a cylindrical piece of sheet metal with a blank end forming a cap is placed over the nose of the shell.

Into the blank end of this sheet metal cylinder or cap is placed a hose connected with the high pressure air lines of the shop. The air pressure is released and all chips are blown out and are deflected downwards again by the sheet metal cap and on to the table. A new supply of cutting lubricant is put in the shell and the finish cutter for the powder pocket is put down. On this boring bar a tool is also placed for facing the end of the nose of the shell, which tool acts as a stop when the finish depth of the cut has been reached. Next the finishing tool for the diaphragm seat is put down into the work. There is a stop collar on this bar which determines the proper depth to which the tool may be fed into the work. This completes the series of operations on this particular machine. The shells are also tested by the tools shown in Fig. 25. Two of these Bullard vertical boring mills are used in boring the shells, and both are similarly tooled.

Heat Treatment and Closing-in Nose.

From here the shells go for heat treatment. There are here two Canadian-Hoskins gas furnaces, which operate on city gas, and between these an oil tank for quenching is situated. This tank was built in the tank and tender department of the works. Whale oil is used in the tank. To each furnace an attachment is fixed, into which the exhaust flue gases of the furnace are led, and the heat used to

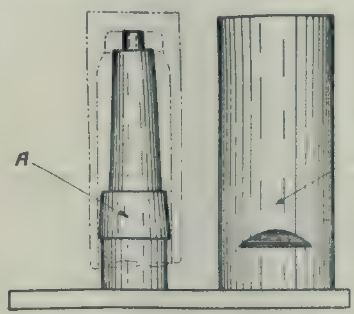


FIG. 20—MARKING SHELL TOOLS.

preheat the shells. The muffle of this preheater is of the same size as the muffle of the furnace. Fig. 7 shows one of these furnaces with the preheater attached. Twelve shells are heated in a batch, in both the preheater and the furnace proper—that is to say, that twenty-four shells are being handled at one time by the furnace. It is obvious that this arrangement not only is a time-saver, but is using fuel to good advantage.

The muffles of the furnaces are filled with a half-and-half mixture of barium and potassium, which, of course, is molten at the temperature of 1,450 to 1,500 degrees Fah. maintained in the muffle. The shells are taken from the preheater and placed, open end upwards, in the molten mixture in the muffles of the furnace. When the twelve shells are in the muffle they are completely submerged in the liquid, and are heated very quickly to the required temperature of 1,460 degrees Fah. Also, there is an entire absence of any oxidation of the carbon in the steel in the shell. As can be noted in Fig. 7, a Bristol electric pyrometer is used in connection with the furnaces to inform the operator at all times of the temperatures existing in the muffles of his furnace. From the furnaces the shells are taken to the oil quenching tanks. The heat of the shells tends to raise the temperature of the oil higher than that desired, thus a series of coils, through which cold water is circulated, is placed in the bottom of the tanks. To assist these coils further in cooling the oil, jets of compressed air in the bottom of the tank from the high pressure lines of the company agitate the oil. After the week-end shut down during the cold winter months it was found that the oil was too cold to obtain good results; therefore, a second series of coils was placed in the tank, and through these coils steam was circulated until the temperature of the oil was in the neighborhood of 60 degrees Fah.

The shells are next placed on shelves of woven wire on the inside ends of the tank, and the oil allowed to drain from them. From here they are taken to a hot soda bath and washed. One man

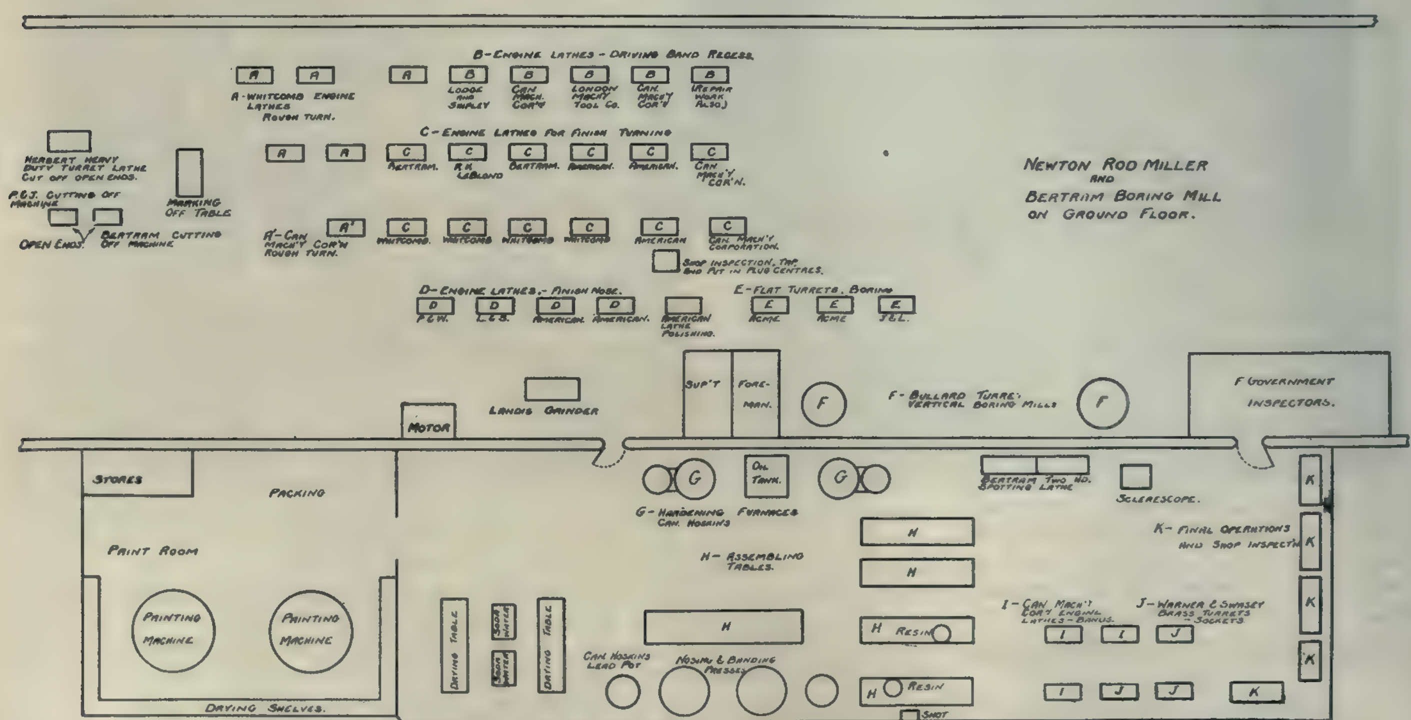


FIG. 18. TOP—LAYOUT OF STEEL WORKING SHELL SHOP. FIG. 19. BOTTOM—LAYOUT OF HEATING, TREATING AND FINISHING DEPARTMENT.

handling the two furnaces is able to harden 360 shells in a shift of 11½ hours.

From the washing operation, the shells are taken to the spotting operation. A McKechnie & Bertram lathe

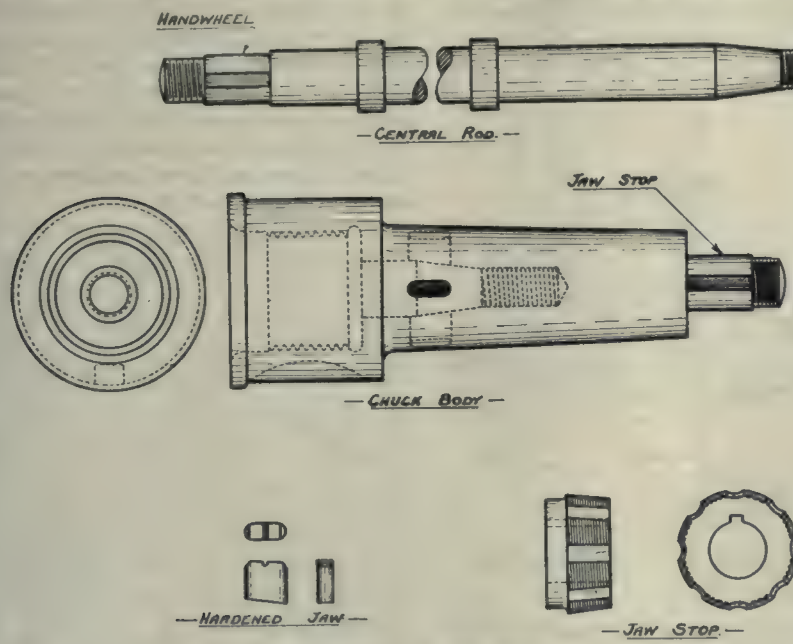


FIG. 21—DETAILS OF EXPANDING CHUCK.

with two head stocks mounted on the ways is used here. Each head stock is fitted with a four-jaw chuck. The shells are roughly chucked and a ring near the recess is polished up with files and emery cloth. From here the shells proceed to have their hardness tested with a Shore scleroscope. This clean-up and hardness test department has put through 984 shells in an 11½-hour day.

The shell is next taken to the nosing press. The noses are heated to 1,400 degrees Fah., two lead pots, one a Canadian-Hoskins make and the other a product of the Chicago Flexible Shaft Co., being used to accomplish this. From out of the molten lead a rod extends, and the shell is placed over this; thus the lead is in contact with the nose of the shell, a distance which will heat it properly for the nosing press operation. On the surface of the molten lead, charcoal is placed, which prevents the lead from oxidizing or an excessive amount of heat radiating from it. Further, the lead when covered with charcoal does not seem to adhere to the nose of the shell. The shell is left immersed in the lead for one and one-half minutes, which time is indicated by a little sandglass egg-timer. The lead pots and two nosing presses are shown in Fig. 8. Only one press is used for the 18-pdr. shell, the other being fitted up with jaws and dies for a larger shell.

After being taken from the lead pot, the diaphragm is placed in the shell and the nose is bottled on the press. The nose is again placed in the lead pot for a moment, being held in a pair of tongs by the operator. This second immersion in the lead pot heats up the nose again and tends to remove all effects of chill caused by the hot nose coming in contact with the cold steel dies. The shell is removed from the lead pot and allowed to cool slowly in the air. This department has closed-in and annealed 690 shells in a day of 11½ hours.

The body of the shell is not annealed in the usual course of events. However, should difficulties in turning arise later, it is brought back to this department and annealed. Very few shells have presented difficulties in turning.

Finishing the Inside of the Nose.

The shell is next taken to the lathes, where the finishing operations on the inside of the nose are completed. Four engine lathes, with turrets mounted on their carriages, are used in this operation. Two of the lathes are American machines—one a Pratt & Whitney and the fourth a Lodge & Shipley. Fig. 9 shows one of the American lathes tooled up for this operation. A collet chuck is attached to the live spindle, the details of which are shown in Fig. 27. The shell is chucked against a stop. On the turret there are four boring bars mounted.

The first tool to enter the work is shown at A in Fig. 28. This tool bores the inside of the nose. As will be seen in Fig. 9, at the back of the carriage there is a stop which swings on a pivot, and this stop when swung over and pointing toward the head stock indicates just when the turret is in the centre of the machine. The tool is thus located with regard to its central position. Immediately under the collet chuck bolted to the ways is located a cast iron stop, shown clearly in Fig. 9. The little V-shaped stop shown at C in Fig. 28 is placed on the V-ways in front of this cast iron stop, and the carriage of the lathe is fed up till it butts against this little stop. The turret has been previously located with regard to its central position, and thus the inside of the nose is bored straight. The tool is withdrawn and the inside of the nose is next rough turned and formed. The tool that accomplishes this work has a wide cutting edge ground to the contour of the shell. This tool is shown at B in Fig. 28.

The boring bar carrying this tool is moved in through the open end of the

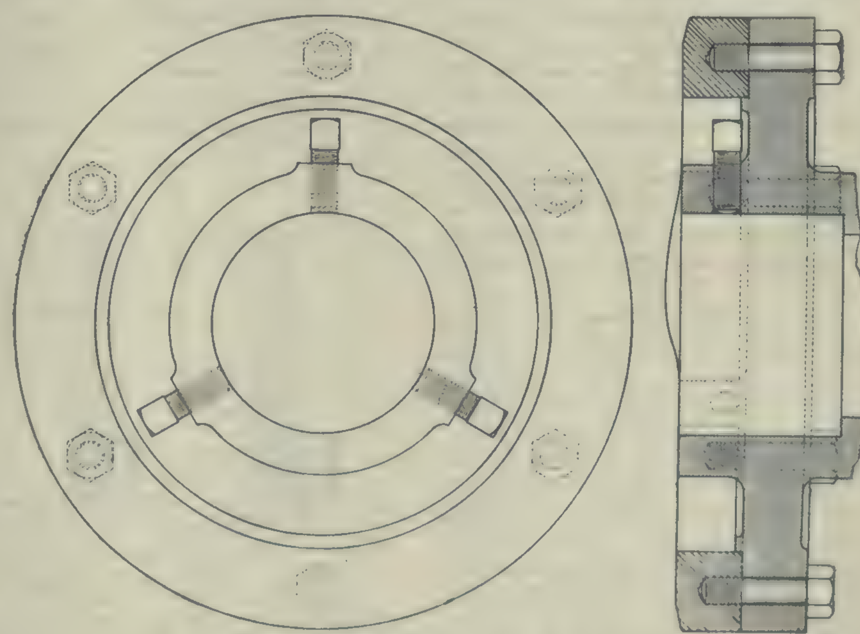


FIG. 22—THREE POINT CAM BOLTED TO SPECIAL CHUCK.

nose, and the carriage is run up against the cast iron stop bolted to the ways under the collet chuck. Next, a similarly shaped tool is run into the work, and this tool finish turns and forms the inside of the nose. This tool is located by the same stop as was used in the case of the roughing tool. Both tools are fed into the work against the same stop.

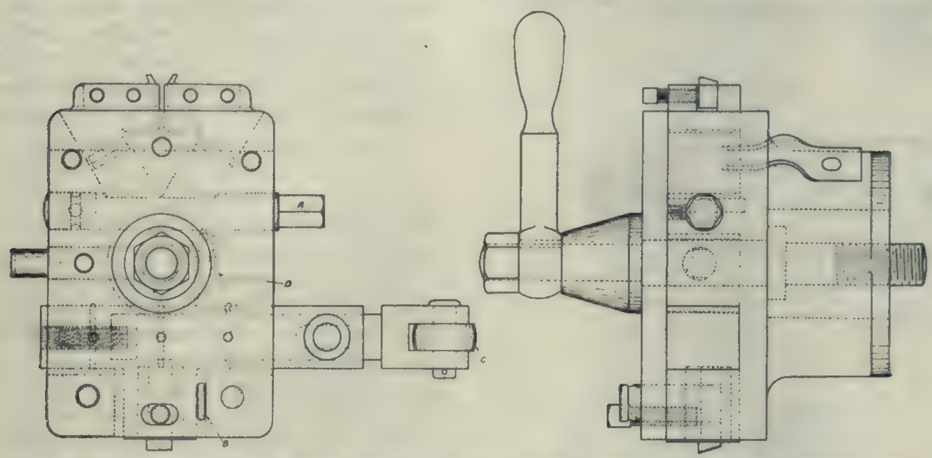


FIG. 23—TOOL HOLDER FOR TOOLS FORMING WAVED LINES AND UNDERCUTTING.

The fourth bar carries the collapsible tap, which tool is run into the nose, tapping same. The tap is mounted on the boring bar on a sleeve which allows the tap to feed freely into the work independently of the carriage. Of course, this sleeve butts against a shoulder which starts the tap into the work. Soda water cutting lubricant is used on all the operations except tapping, in which operation raw linsed oil is run over the tap. Before the firm received its collapsible taps, a straight tap was used. A back belt on the lathes enabled the tap to be backed out. No provision is made to keep the diaphragm out of the way of the boring bars, as it has been found that the bars are sufficiently large to always force the diaphragm back out of the danger zone. The production of one machine is 91 shells in an 11½-hour shift.

Finish Turning.

The shells go from this operation to a shop inspection table, where a finish tap is also run into the nose. Next a small steel plug is screwed into the latter. This plug has an extended shank, two sides of which have been flattened, and in the end a centre is placed. This plug is shown in Fig. 29. As soon as the plug is screwed in, a small amount of a thick paste of white lead cut in oil is placed in the centre and the shell is passed on to the lathes for finish turning. The lathes for finish turning are all standard hollow spindle engine lathes with special attachments, and are so arranged, as shown in Fig. 18, that one man can operate two machines. A special collet chuck shown in Fig. 29 forms part of the equipment for each. The shells are placed in the collet chuck up against a stop, and the nose end is supported from the tail stock centre. In each lathe the cross slidé feed screw has been disconnected.

Fig. 10 shows in the right foreground the rear of a Canada Machinery Corporation lathe, and in the left background the front of an American lathe equipped for this work. At the rear of the Canada Machinery Corporation machine two cast iron brackets bolted to the frame are seen, to which in turn is bolted a flat piece of machinery steel. The piece of steel has been hardened and the edge nearest the machine is ground to the exact profile of the shell. At the rear of the cross slide a fixture is bolted, which carries a hardened steel point. Two pieces of small diameter steel rope are attached to the cross slide and pass over two small sheaves on the back edge of the carriage and fasten into two eye bolts which are screwed into a heavy cylindrical cast iron weight. This weight causes the steel point carried on the fixture, bolted to the back of the cross slide, to always press firmly against the profile template of machinery steel carried on the brackets at the back of the lathe. The tool is fed into the work by means of the compound rest. The carriage is travelled by power, and the cross slide follows the exact profile of the hardened steel template.

A round-nosed tool is used in this work, and particular care is exercised to have it ground with the correct clearance. No cutting lubricant is employed, and, at the same time it is necessary to have a smooth finish on the shell. Each operator is provided with limit gauges with which to caliper his work. The tooling is giving no trouble whatever, and one man on two machines can turn out 71 shells in 11½ hours.

Grinding Back Ends.

The shells, after leaving the finish turning lathes, have the small plug centres removed and pass on to the Landis grinder, shown in Fig. 11. Here the recess is cleaned up and the diameter at the rear of the driving band recess is also cleaned up and polished with a buffing wheel and a fine emery wheel. The back end is similarly treated. Three nicks are made with a cold chisel in the wave lines in the bottom of the groove to allow the air to escape from between the wave lines when the copper band is pressed in the groove. The shell now passes on to the preliminary Government inspection, as the final operations in the process of machining the steel shell proper have now been completed.

Applying and Turning Copper Bands.

From the Government inspectors, the shell goes to have the copper driving bands applied. These bands are received in the form of a circular copper ring which is sufficiently large to slip over the back end of the shell. They are slipped into the recess and a blow from a hammer elongates the ring sufficiently to cause it to be retained in the recess. The shell then passes on to the pneumatic banding press shown in Figs. 8 and 30. The jaws of the press are slightly corrugated horizontally and are closed on the bands. The length of stroke of the piston is regulated by the six set-screws shown in Fig. 30. Relief valves in the piston eliminate all shock from the frame of the machine.

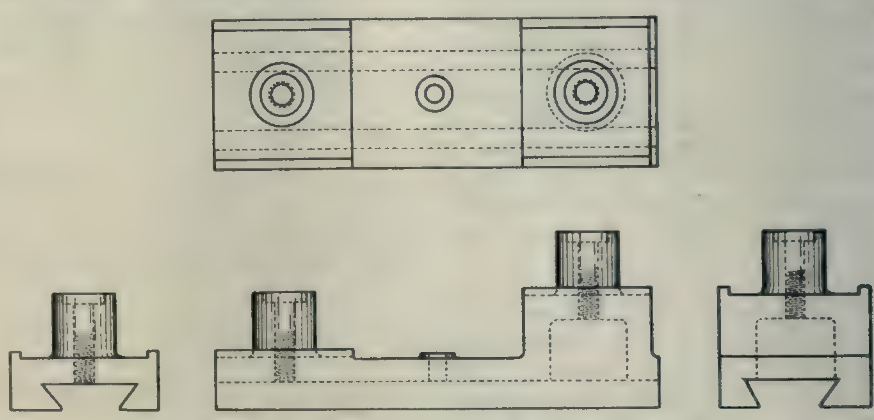


FIG. 24—CROSS SLIDE TO CARRY TURRET HEADS.

When the end of the stroke is reached, the jaws pressing the band into the groove are practically touching one another at the sides. The toggle motion transmitted to them from the pneumatic piston causes them to converge as the piston ascends, while gravity causes the piston to descend as soon as the air pressure is released from under it. This is done automatically by the relief valves, which can be set to open at the end of the adjustable stroke of the piston. After the first pressure, the shell is given a slight twist and a second pressure of the jaws is applied. Thus, a batch of forty or fifty shells is done. A small round plate of ⅛-inch steel is now placed in the machine and the shells, thus raised up ⅛ of an inch, are all given two more applications of the jaws similar to those just described.

The use of the corrugations on the jaws is here made manifest. The high points on the jaws press against the high points on the bands left there from the first two pressing applications. The result is that the band is pressed into the very corner of the undercut edges of the recess and the wave lines are imbedded into the copper perfectly. The diameter of the piston is 28 inches and the air pressure used is 100 pounds, thus four applications of the jaws press the copper bands into the grooves very firmly indeed. The press has never been employed for long periods in applying the driving bands, but in one hour it has banded 200 shells, while a batch of fifty shells was done in some ten seconds less than fourteen minutes.

Changing this press over into a nosing press is done by simply inserting the steel plug A, shown in Fig. 30. The shank of this plug is smaller in diameter than the pressed driving band, thus the toggle actuated jaws do not come in contact with the shank. The shank extends down and rests on the top of the air piston, and thus it gets its motion. The shell is placed on the plug and is moved upward and the nose comes into contact with the nosing dies placed in the fixture above.

The shell goes next to the band-turning lathes. Three Canada Machinery Corporation engine lathes are tooled up for this operation. Each lathe is equipped with a collet chuck as shown in Fig. 12. The shell is placed up against a stop and the back end is supported by a revolving centre placed on the tail-stock spindle. The tool holder shown in Fig. 31 is placed on the cross slide. The roughing tool is used to trim up the band after the carriage has been placed against its locating stop. After the roughing cut, the carriage is placed against a second locating stop and the finishing tool is fed into the work and the band turned to finish size. The cutting edge of finishing tool is ground to the correct profile as shown in Fig. 31. The operator is provided with a snap gauge to caliper the work. When the finishing tool is being used, the roughing tool is swung back to clear the edge of the chuck, the method of swinging back this tool being indicated in Fig. 31. One man on a lathe tooled up as indicated above, has turned 122 copper bands in six hours.

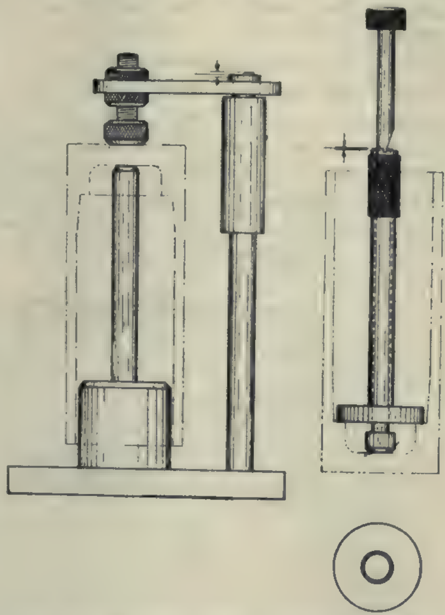


FIG. 25. GAUGES USED AFTER BORING.

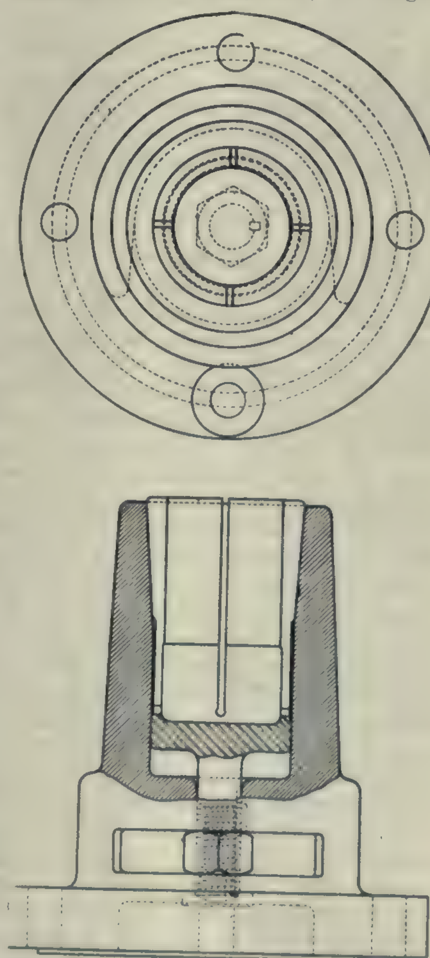


FIG. 26 SPLIT COLLET CHUCK ON BULLARD BORING MILL.

Assembling.

The shell is now ready to go to the assembling department, the first operation there being to put in the tin powder cup under the steel diaphragm and screw in the brass powder tube. After this has been done, a piece of pipe is placed over the brass powder tube and the steel disc is driven home to its seat with a hammer blow on the top of the iron pipe.

The shot is next put into the shell, being received from the cars and carried by an electric travelling crane to the wooden hopper shown in Fig. 13. It is run down from a feed pipe from the bottom of the hopper to the rectangular chutes surrounding the resin pot, on an incline, shown in Fig. 13, to the automatic measuring device. The pot which heats the resin being itself very warm, communicates a great deal of heat to the lead bullets in the circular chutes; thus the shot is heated. The shell is placed on the air vibrator and a charge of shot poured into it through the brass funnel to which a central rod is attached, and placed in the powder tube. This rod thus not only centres the powder tube but prevents any foreign material from passing down it. Fig. 32 shows the funnel. The air vibrator settles and closely packs the shot into the shell.

The next operation is to remove the funnel and place a little wooden plug in the top of the powder tube. Then the resin is run into the shell from one of the two resin heating pots which were made in the plant. The shell is next placed on a delicate balance and a piece or two of small buckshot added until the correct weight is attained. The brass sockets with their threads coated with red lead are now started in the noses by hand, the shell being placed in the clamp shown in Fig. 33. The steel plug, shown in Fig. 34, is screwed into the socket and securely held there with the nut N locked. The socket is thus screwed home while the resin is still hot. The little powder tube now projects through the central hole of the socket and a circular piece of wire solder is placed around it. A special shape soldering iron is used to solder the tube to the socket. Thus the assembling is accomplished. Six men working in this department are able to assemble 130 shells in 2 hours. Fig. 14 gives a view of the assembling department.

Finishing Brass Sockets.

Three Warner & Swasey brass turning turret lathes are tooled up for this work, the shell being held in a collet chuck with outer end supported in a

steady rest. Two cutting operations only are required, the end of the powder tube being trimmed up by a flat drill ground square on the end. The second operation is accomplished with a yoked tool holder. Fig. 15 shows the tooling of one of these Warner & Swasey turret lathes. Fig. 35 also illustrates same. The yoked tool holder contains the tools for turning and forming the outside of the brass sockets. This tool is simply fed into the work. The corner C of the little gauge shown at G in Fig. 35 is held against the shoulder formed by the tools in brass socket. Thus, when the edge F comes against the outer edge of the socket the latter is turned to the proper diameter. This tooling is exceptionally simple and some remarkable records in socket finishing have been made. Next a little reamer with a long T handle is run into the powder tube by hand to to clean out any burrs. One man has turned on one of these machines 368 sockets in 11½ hours. The shell is now taken out and inspected by a shop staff. The heat treating, assembling, finishing copper bands and sockets, and final operation departments are shown in Fig. 16.

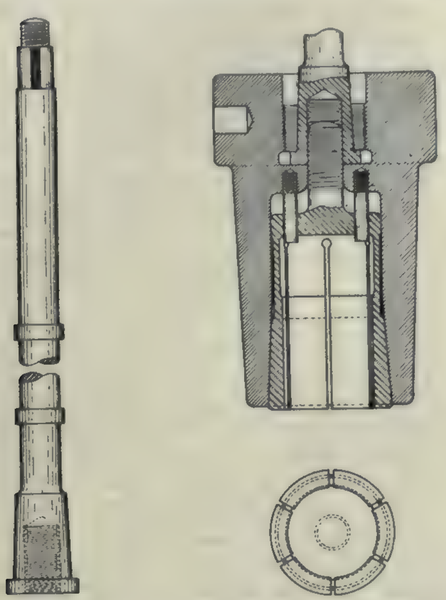


FIG. 27. COLLET CHUCK FOR FINISHING INSIDE OF NOSE.

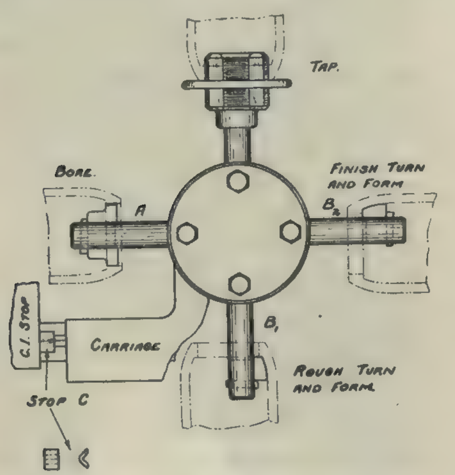


FIG. 28. TOOLS FOR FINISHING INSIDE OF NOSE.

Final Operations.

The shell is next taken to an inspection table where a tap is run into the brass socket to clean out the thread and to have a plug screw gauge run in to test it. A small tap is also run into the grub screw hole in the socket to clean it out. Compressed air is used to blow all dirt out of the powder cup and tube. The shell is marked on a Dwight slate stamping machine, which stamps 300 shells in 6 hours. The shell afterwards proceeds to the final Government inspection.

Painting.

From the final Government inspection the shell goes to the painting department. Two painting machines located here are really among the most interesting of any tools in the whole department. Fig. 17 shows these two machines each with their full complement of 60 shells in position. As the shells come from the final Government inspection, brass castings, shown in the details of Fig. 36, are screwed into their noses, then the shells are placed on the machine. The paint can is supported in a holder which can be moved around the outside of the machine. The painter takes his brush in hand and pushes the shell inward. This causes the bevelled friction surface of the brass casting to come against the bevelled surface of the central revolving disc. The shell is thus rotated, and the painter applies the paint with the greatest of ease. He proceeds around the entire sixty shells, pushing inward those that are stationary, causing them to revolve. He pushes his paint can ahead of him and paints the entire number in a remarkably short time. In Fig. 17 the shells are all shown in their outward stationary position.

In painting the finish coat and red leading the nose, this machine allows him to paint right to a line with the greatest ease. Steam coils are placed in the centre of the machine and the shells can be left on the machine and dried very quickly after the priming coat has been applied, the steam-coils sending a current of warm dry air up around them. The walls of the room are lined with shelves on which little spindles are placed which fit into the brass castings screwed in the sockets of the machines. Here the shells are placed to dry after the finish coat has been applied. After the shells are dry, the brass casting is unscrewed from the socket, the little brass plug screwed into the latter, and the shells packed in boxes of six each and shipped.

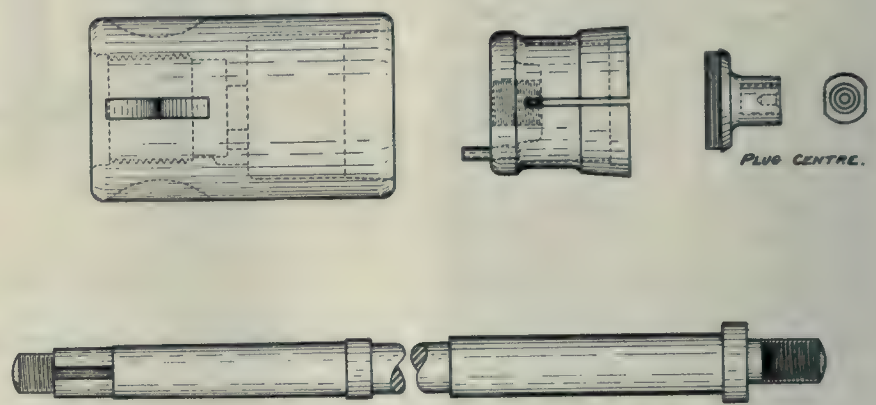


FIG. 29. COLLET CHUCK AND CENTRE FOR FINISH TURNING.

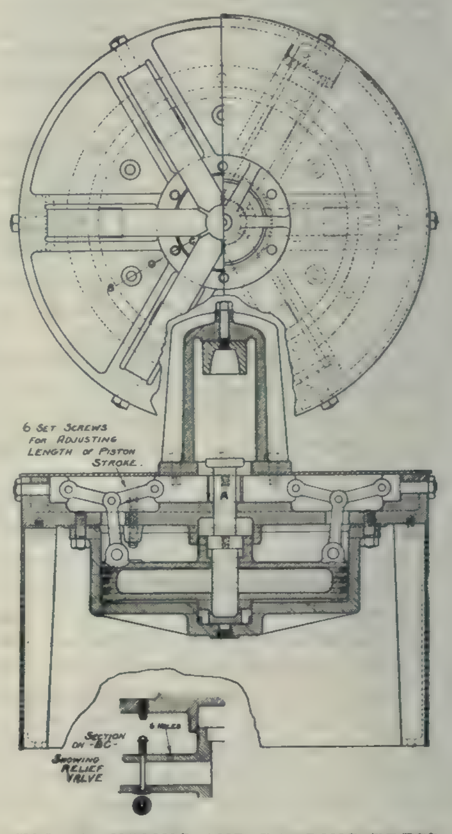


FIG. 30. NOSING AND BANDING PRESS.

One painting machine was loaded with shells which had received their priming coat and the other machine was loaded

with unpainted shells. One man applied the priming coat to the sixty unpainted shells and then applied the finishing coat to the shells on the other machine and painted the noses with red lead all in twenty-one minutes. His helper during this time removed all the shells from the machines to the drying shelves on the walls grasping each by the brass casting and the copper band thus not touching a painted surface. Thus, one man completely painted, priming and finish coats, and red leaded the noses, in twenty-one minutes which is a record accomplishment. The details of the machine are shown in Fig. 36.

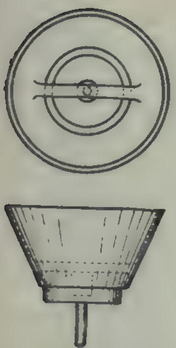


FIG. 32—FUNNEL.

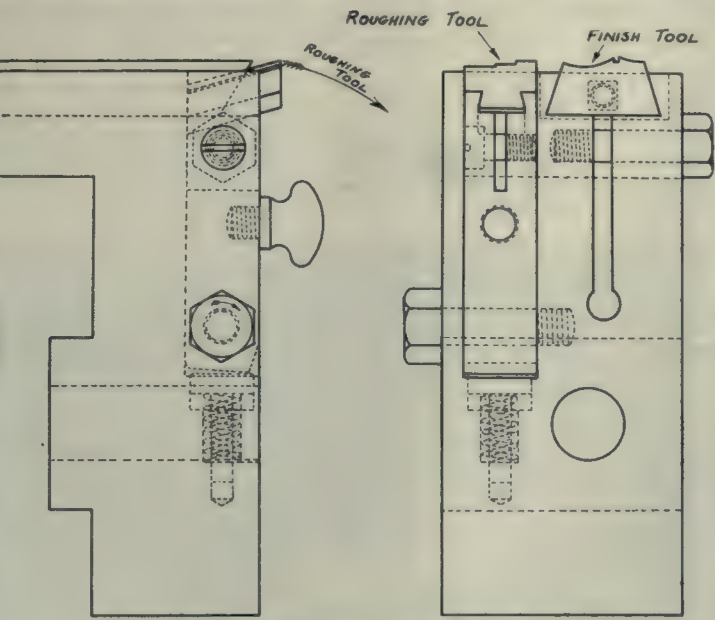


FIG. 31. TOOL HOLDER AND TOOLS FOR FINISHING COPPER BANDS.

General.

The shells are transported about the shop on Chapman double ball bearing elevating trucks. The platforms hold forty shells each. The entire shell shop is on the second floor of the building and on the main floor is located two motor driven rotary gear pumps which supply the soda water cutting lubricant to the pipe line system which in turn supplies water to the various machines. The water all drains back by gravity through strainers and is led into the main sump on the ground floor of the shop. Workmen are provided with tools which are carefully made and inspected by a corps of competent men.

The natural lighting of the shop is by means of large monitors composed of glass and ample skylights. Windows in the side walls also contribute to the good natural lighting. The artificial lighting is from Cooper-Hewitt lamps and nitrogen incandescent lamps, while each operator is provided with an individual tungsten lamp. Remuneration is on the piece work plan in practically all departments where the system can be employed. There are two shifts of 11½ hours each per day with no Sunday work. The entire department shown in Fig. 16 and Fig. 19 is on a mezzanine floor overlooking the main machine shop and erecting shop. The plant is working to capacity and is extremely well balanced.

Fig. 36 and an accomplishment record of this plant will be found on next page.

SHRAPNEL SHELL SERVICE FEATURES.

SHRAPNEL possesses greater man-killing power than any other kind of ammunition used in modern field artillery, and that is why more than 1,000,000 shells a month are being used by the European armies now in the field. Thousands of shops and factories on this continent and in Europe are working night and day to supply the demand.

A superficial examination of a shrapnel shell discloses little to indicate its destructive power—it is simply a small steel shell attached to the end of a brass case; but when properly adjusted and fired from a modern field gun this steel shell becomes a veritable demon of destruction. Within the brief period of 4¾ seconds it has travelled over one mile, and 17¼ seconds later it is nearly 3¾ miles distant from the gun. At any time during this rapid flight it can be made to explode with marvelous precision and deadly effectiveness.

Each shell has a time fuse made with the accuracy of a watch. This fuse is graduated in seconds, and is set to explode at a given range as determined by the panoramic sight or other form of range finder. As soon as the gun is fired, the fuse is ignited automatically and when the explosion occurs in the base of the shell itself, the forward end is blown out and a shower of lead bullets hurled forward in cone-like formation, the shell acting as an aerial gun. The velocity of

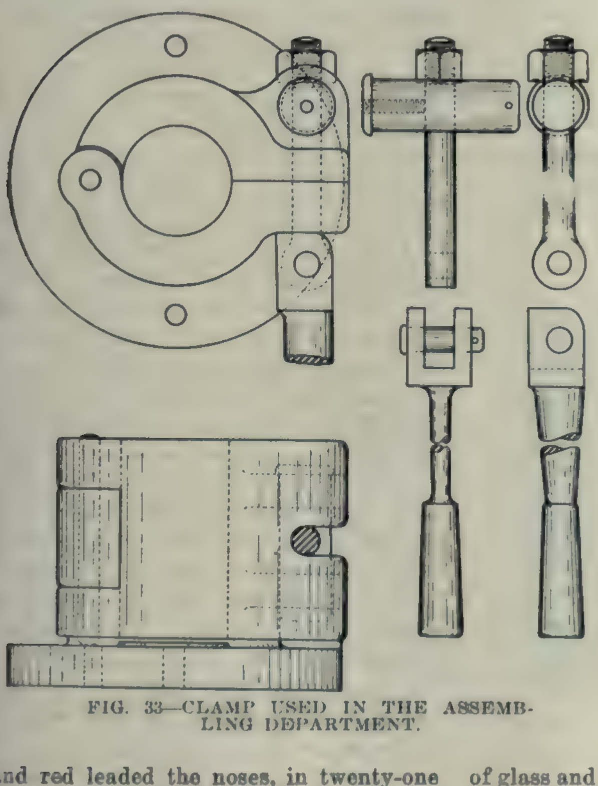


FIG. 33—CLAMP USED IN THE ASSEMBLING DEPARTMENT.

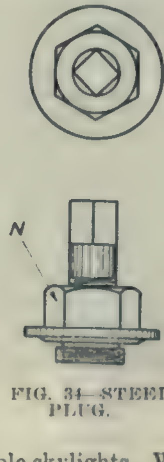


FIG. 34—STEEL PLUG.

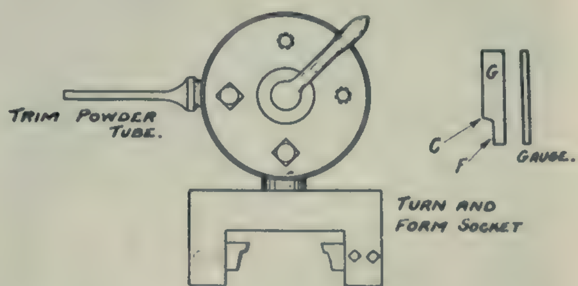


FIG. 35—TOOLS FOR FINISHING BRASS SOCKETS.

these bullets exceeds the velocity of the shell at the time of the explosion by from 250 to 300 feet per second, and they cover a zone about 30 yards wide and 250 yards long.

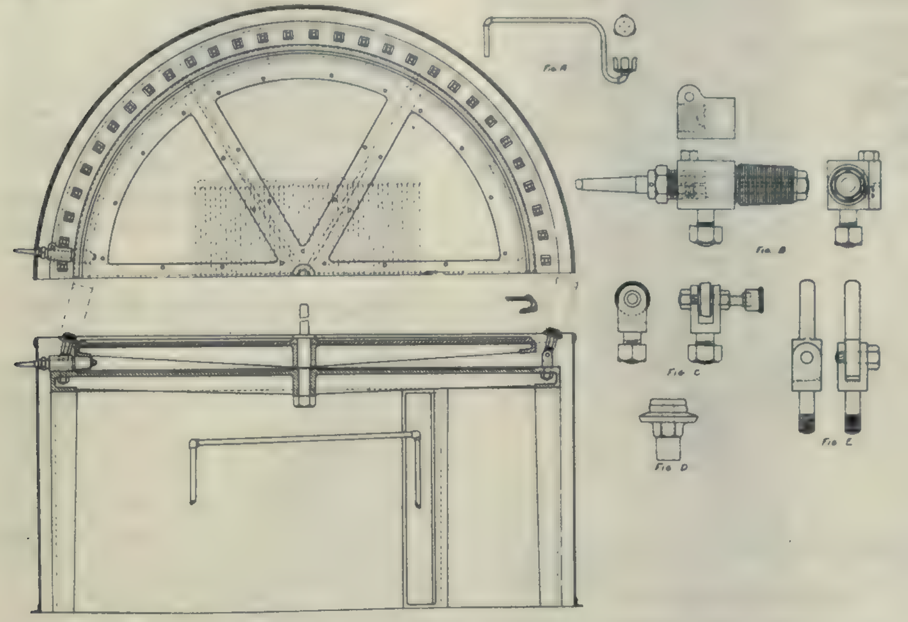


FIG. 36. DETAILS OF PAINTING MACHINE.

A Bracket to carry paint can made of 1¼-inch pipe and fitting over the central stationary spindle on the machine. B--Laminated leather friction roller; one of three supports carrying the revolving table. This roller acts as a driver for the revolving table; the central spindle is tapered on one end and runs through a brass bush and on out of it, forming the core for the leather laminations which are in the form of a taper. C—Type of idler rollers, of which there are two, supporting the revolving table in conjunction with the laminated leather roller. D Brass casting to screw into brass socket of shell previous to mounting shell on the painting machine. E—Hinged bolt, of which there are sixty mounted on the frame of the machine. Shell with the castings shown in Fig. D are slipped over the hinged bolts.

Invented in 1784.

The first shrapnel shell (invented in 1784 by Lieutenant Shrapnel) was merely a cast-iron ball filled with bullets and powder, which was exploded by a crude fuse screwed into the shell. This type was unsatisfactory because bullets flew in all directions when the shell exploded. Later this defect was partially overcome by inserting a sheet-iron diaphragm, which separated the bullets from the bursting charge. Modern shrapnel is similar in principle to its early predecessor, and is a marvel of mechanical ingenuity.

The shrapnel shells used by different governments at the present time operate on the same principle, but differ somewhat as to size and in the arrangement of the fuse. A complete shrapnel shell comprises a brass case containing a heavy charge of smokeless powder for propelling the projectile, a hollow steel shell containing a large number of lead bullets and a bursting charge, and the combination time and percussion fuse which forms the point of the shell. The sudden motion of the shell at the time of firing causes a small plunger in the end of the fuse to fly back and strike a cap which ignites the fuse. This fuse is composed of a slow-burning composition that is pressed into annular grooves. One of these grooves is in a stationary ring and the other in a graduated movable ring. By turning the graduated ring, the length of this fuse is varied so that the shell may be exploded at any time within a period of about 21 seconds.

The French Fuse.

The French fuse differs from the movable ring type used in other countries, in this respect. The slow-burning composition is contained in a tube wound spirally around the fuse head. The fuse is set by piercing a hole through this spiral tube, so that connection is made with the interior of the fuse body. When the gun is fired and the primer or cap in the fuse head is exploded, a flame passes out through the pierced hole and ignites the "rope" powder fuse. The effective length of the fuse depends upon the position of the pierced hole, which is made by a special machine attached to the gun, the hole being located with reference to suitable graduations. Most fuses are so arranged that the shell will be exploded by concussion if it should strike before the ring of powder burns around to the exploding charge. This is effected by a secondary plunger in the fuse head which flies forward when the shell strikes and fires the bursting charge instantaneously.

Shells of the three-inch size contain from 210 to 360 lead bullets about half an inch in diameter, which are embedded in a resinous mixture. This matrix, as it is called, serves two purposes. It holds the bullets in position, and also acts as a tracer to indicate by a cloud of smoke the point at which the shell explodes. This smoke cloud is important, especially at long ranges, and when adverse atmospheric conditions exist.

A shrapnel shell, in common with other types, must be revolved about its axis during flight to keep the point forward. This rotary motion is imparted to it by a copper band that is pressed into a groove near the base. When the gun is fired, this band, being imbedded into the spiral rifling grooves in the gun barrel, imparts a sudden twisting motion to the projectile.

The combination time and percussion fuse which is screwed into the end of the shell is composed of many parts, which must be made very accurately.

Shell Production Records in Locomotive Shop.

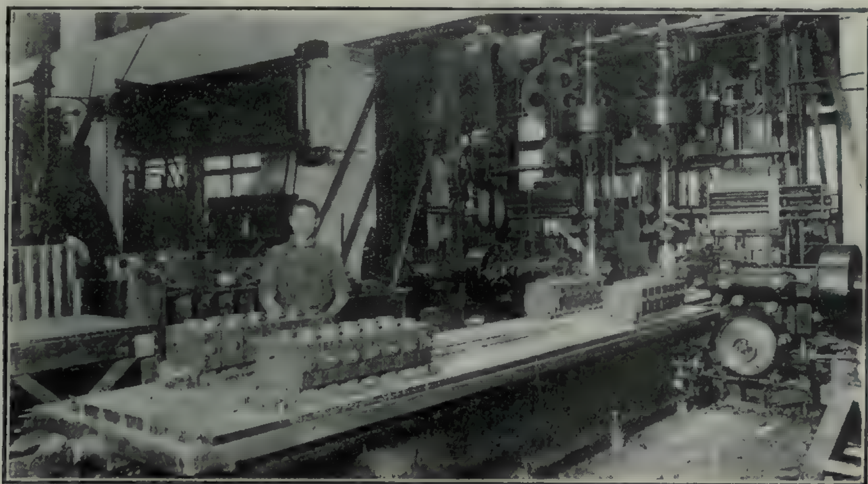
Operation.	No. Pieces.	Hrs. worked.	Rate per hr.
Mark off	808	11½	70.2
Cut off thin end	285	11½	24.8
Mill solid end	796	11½	69.2
Rough turning	90	11½	7.8
Band recess	125	11½	10.8
Boring for tin cup and disc	186	11½	16.1
Harden	360	11½	31.3
		(1 man and 2 furnaces.)	
Sclerescope test	984	11½	85.0
Closing nose and anneal	690	11½	60.0
Boring inside of nose and tapping	91	11½	7.9
Finish turning body	71	11½	6.1
		(1 man and two lathes.)	
Apply driving bands		1	20.0
Turn driving bands	122	6	20.3
Assembling (six men)	130	2	65.0
Finishing brass sockets	368	11½	32.0
Stamping	300	6	50.0
Painting (1 man and helper)	240	2	120.0

Shell Manufacture in a General Engineering Plant

Staff Article.

Perhaps the most fortunate of the various manufacturing institutions in its ability to readily take over the shell business is the general engineering plant. The equipment usually requires comparatively slight alteration, and there are also at hand the type of men and scope for designing and building any necessary special apparatus at short notice.

THE unexpected change of employment of the greater number of Canada's metal working plants from the production of articles of peaceful commerce to the fabrication of munitions of war has been done at more or less sacrifice depending largely upon the character of the plant. The methods herein described for the manufacture of shrapnel shells are those adopted by a plant whose regular equipment is unusually well suited to the different processes involved. The product for which original machines were installed consists of internal combustion engines in large quantities, and it will be interesting to note the great similarity in the various operations required to those of the more warlike output at present being produced.



CONTINUOUS MILLING OF BASES ON INGERSOLL MULTIPLE SPINDLE MACHINE.

The shells are received at the plant from the steel works in the form of rough forgings. They are unloaded from the cars in a well equipped shipping department on to an auto-car operating on an industrial railway and by means of which they are transported to the shell department beside the machines which perform the first operation—the trimming of the open end. These include a cutting-off machine with two tools and variable feed, a John Hall & Sons, Brantford pipe machine and a heavy standard lathe. The gauging point for this as well as subsequent operations is the bottom of the shell chamber inside.

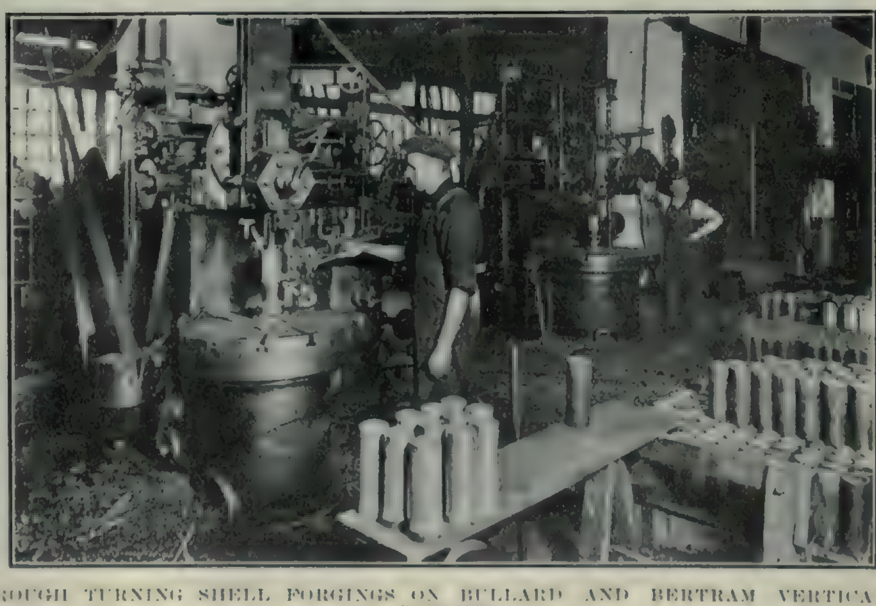
Use of Milling Machines.

The basing or rough facing of the closed ends is done most efficiently upon an Ingersoll four-spindle milling machine, using the two vertical spindle heads. The platen of the machine carries four fixtures located in pairs near either end. These fixtures hold twelve shells each, arranged in two rows of six. The shell is simply dropped over a vertical gauge pin and is clamped, two shells to a clamp in an upright position.

The milling is done by two large, inserted tooth high speed steel facing cutters, one traversing each fixture. While one pair of fixtures is under the cutters, the operator is engaged, at the other end of the table, in emptying and reloading the other pair of fixtures so that the milling process is practically continuous. This has proved a most satisfactory method of doing this part of the work as the machine is powerful and rigid enough to work the high speed steel cutters to their capacity. Another machine of this type is being fitted up and will be in operation shortly.

After gauging for length, the forgings go to the various machines utilized for the outside turning. For this purpose the shells are driven upon mandrels solidly attached to the face plates of the machines. These arbors are solid and are fitted, upon the shank part, with a circular nut. When it is desired to remove the work, this nut is simply tightened against it and a tap with a hammer upon the side serves to release it instantly.

The turning is done on two Bertram and two Bullard vertical turning and boring mills, one Conradson turret lathe, one Gisholt, two heavy Steinle turret lathes and one Pratt & Whitney turret lathe. The Steinle machines are equipped with a special expanding arbor and are used to turn such shell forgings as come slightly large so that they cannot be tightly driven on the solid arbors. The gripping points consist of twelve pins in four circles of three each which are moved outwards against the shell chamber by the wedge action of the

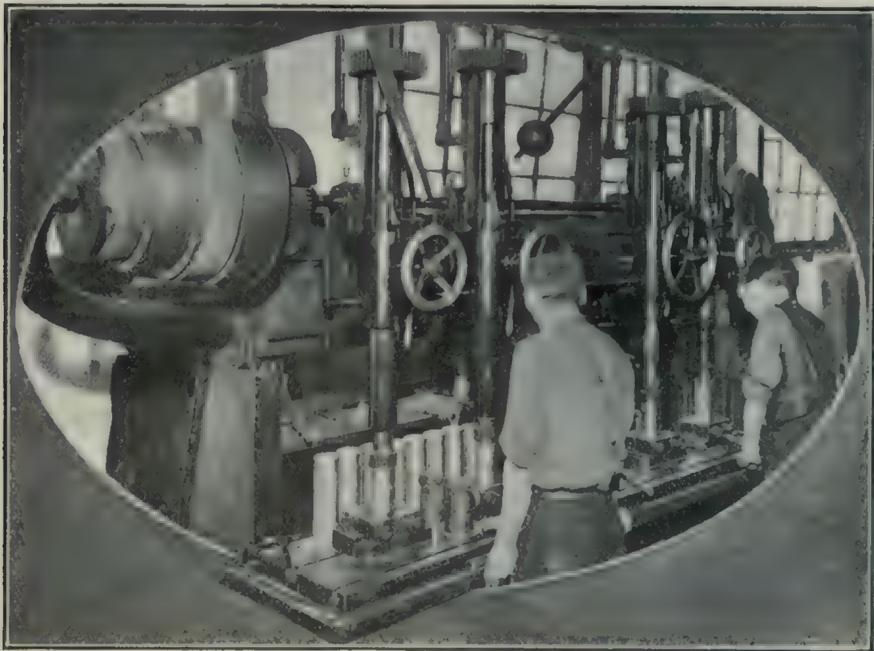


ROUGH TURNING SHELL FORGINGS ON BULLARD AND BERTRAM VERTICAL TURRETS.

spindle which is actuated by a nut at the rear end.

It is interesting to note that, in quantity of production, the competition between the several machines is rather close, the Steinles coming first, the Pratt & Whitney second and the vertical boring mills third, although the difference does not amount to more than from six to a dozen per day.

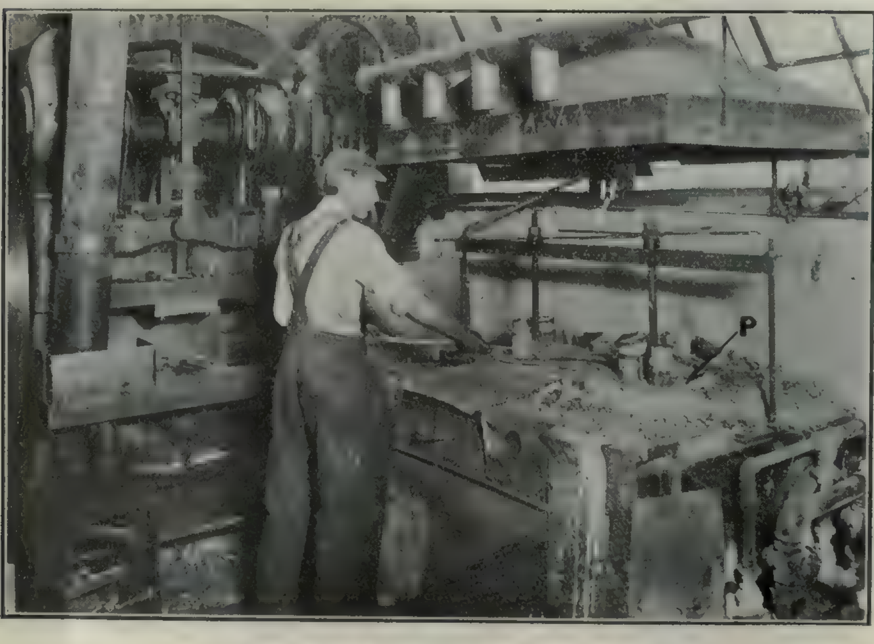
The series of operations consists of rough turning the shell body, finish turning from the band to the base, finish facing the base and roughing out the groove for the band. The work on the groove here consists of cutting down the whole width to the top of the vees of the wave and of cutting down the two edges to the bottom of the vees. The rough turning of the body is carried up to the edge of the part which is nosed in, or, in other words, it involves the cylindrical part of the shell.



BORING SHRAPNEL CASES ON A FOUR SPINDLE FOOTE-BURT DRILL.

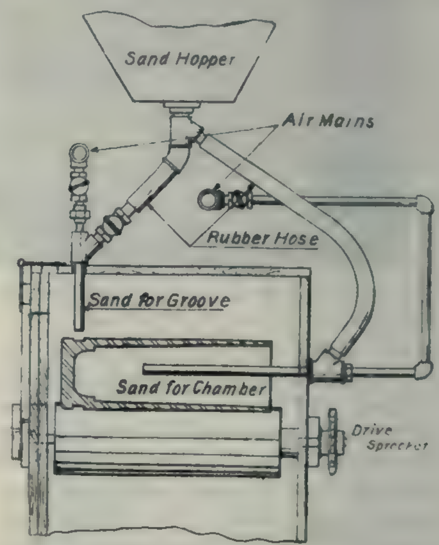
Boring Processes.

The next operation consists in boring the shell in the bottom to receive the powder cup and also for the seat of the steel diaphragm which separates the powder from the bullets. This is also carried out on a number of machines of a widely varying nature. These include a Conradson turret lathe, a four-spindle Foote-Burt drilling machine, a Bertram horizontal boring machine, and others. At first sight, the latter machine appears extremely clumsy, and heavy for such work, but such has not actually proved to be the case. The rigidity of the machine and the abundance of driving power make up for a great amount of inconvenience and, what was at first a mere attempt to get something out of the machine and to keep it going has proved to be one of the best single spindles on the job, an output of 90 shells being obtained per eleven hours.



NOSE-HEATING FURNACE AND NOSING PRESS.

The multiple spindle drill, while being a very satisfactory machine in point of simplicity of operation and quantity of output, cannot be readily arranged to do the facing of the end; this however, is done on a small machine not large enough to do the boring. The boring tools used consist of two solid bars equipped with flat formed cutters, one for roughing and one for finishing. These cutters or bits possess the advantage of being easily made in numbers, and dull cutters can be quickly replaced by sharp ones without materially interfering with the progress of the work. The Foote-Burt machine operates two roughing and two finishing spindles continuously and is handled by two men.

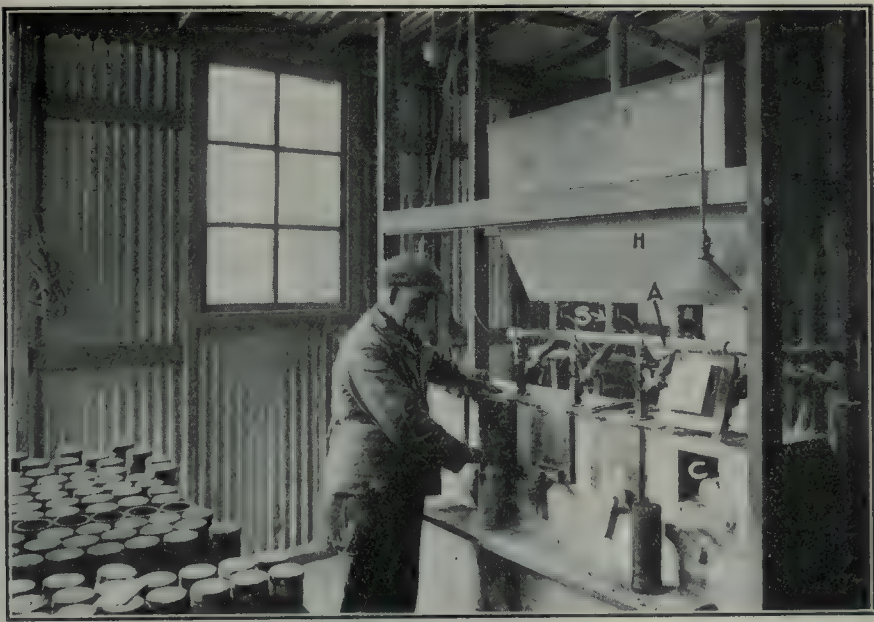


DETAIL OF SAND BLASTING MACHINE.

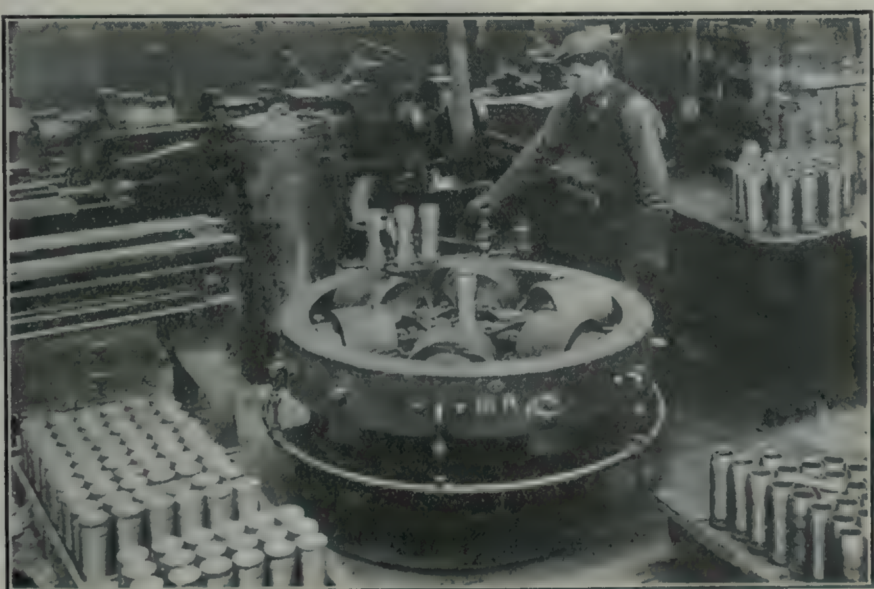
The next operation is that of waving. This consists of turning in the bottom of the groove for the copper band a pair of inverted vees to prevent the band from turning on the shell as it traverses the length of the gun, so called because the vees are cut, not on a flat but on an undulating plane. The waving is accomplished by a square nosed tool with two vees of the correct dimensions cut in the face of it.

An interesting tool making question here arises as, in order that the angle of the vee be correct on the sloping parts of the wave, the angle of the groove in the tool must be greater. The

lateral oscillating motion is given to the tool by a face cam fastened to the face plate of the lathe. The work is done on two R. McDougall and two Bertram geared head lathes, equipped with special centering chucks which grip the work by the turned body. The cam roller is fastened rigidly to the lathe carriage and is held to the face of the cam by a suitable weight. After waving, the open ends are turned for heading on a small lathe by hand feed the purpose being simply to true up this part of the shell, and only enough is taken off to accomplish this.



SAND-BLASTING MACHINE WHICH CLEANS POWDER CHAMBER AND BAND GROOVE.



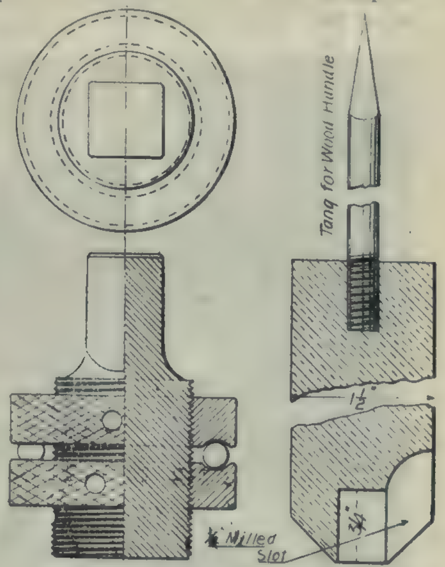
CANADIAN FAIRBANKS-MORSE BRANDING PRESS.

Heat Treatment.

The shells come to this department placed on end in large trays, open ends up, each tray holding 120. A boy now paints the bases and grooves of the shells with a mixture of whiting and alcohol to prevent oxidation of the finished parts during heating, and returns them to the tray closed ends up. For heating the shells, six lead baths are employed, the warming and final heating taking place in separate baths. These pots are heated by oil burners and the temperature regulation is maintained by electric pyrometers. The work is heated for about half its length and, to accomplish this, it is held in a vertical position by the circular cover plate of the bath which contains four suitable perforations to receive the shells which are held down by a conveniently placed weight.

The hardening is accomplished by dipping in oil, three tanks approximately 4 ft. by $2\frac{1}{2}$ ft. by 2 ft. being used. The dipping is done with the open end of the shell entering the oil at an angle of about 45 degrees and is quickly reversed so that the base turns downwards. After chilling the shells are inverted upon hooks placed at the back of the tank to drain and are subsequently removed, cleaned and tested for hardness. For this, the well known scleroscope is used. The test must be applied at a specified distance from the end of the shell and at least three points in its circumference. A feature of the use of the scleroscope for this work is the rapid wear of the bulbs. Unless the very best quality is obtained these wear out at the rate of about one per day.

The next step in the process is sand blasting the groove and the inside or powder chamber. This is accomplished



BALL-BEARING DRIVER FOR SOCKETS. ALSO SOLDERING COPPER.

by means of a very simple and most ingenious machine, devised and built by the Canadian Fairbanks-Morse Co. The apparatus consists of four compartments each just large enough to accommodate a shell and is closed by a wooden door. The shell rests upon a pair of live rollers so that it rotates continuously. One nozzle enters the open end and directs its flow of sand at the internal surfaces to be cleaned while another, in a vertical position cleans the groove and its undercutting. There are of course, four pairs of nozzles and the process is completed as fast as one man can handle the shells.

The forming of the nose is done on a heavy geared stamping and forming press. The furnaces used here are worthy of note. These are the usual oil heated lead baths covered with circular plates containing four openings to hold shells in the proper vertical position. The plates are connected to vertical spindles provided with four arms at

the top so that, as a hot shell is removed and replaced by a cold one, the disc plate can be rotated a quarter turn to bring a fresh hot shell into position for the press man. The shells after nosing are allowed to cool slowly.

The final operation on the base of the shell consists of cleaning and polishing on a rag wheel to remove all signs of the heating operations. The machining of the nose constitutes another series of operations, the first of which is the rough turning of the outside. This is accomplished by means of a plate carrying a cam slot and attached rigidly to the bed of the machine. This slot effectively guides the cam roller which is rigidly connected to the lathe cross slide and thus restricts the motion of the tool so as to give the correct contour to the shell nose.

The roller is held securely to the guiding face by weights and the feed of the tool is regulated by stops, a solid plate gauge being used to test for size over all. The nose is bored in the same way after grinding with an ordinary diamond point tool held in a short stout boring bar. The lathe carriage is guided in a cross-wise direction by means of a cam attached to the rear of the lathe bed as before.

The finish facing and tapping are done on turret lathes, a solid tap being used which is backed out by reversing the lathe spindle. The shells are now ready for grinding for which three Norton grinders are used. The finishing of the shells by grinding is considered a success in every way by the management of this plant and they have deviated but little in their methods from standard practice.

The shells are centred by chucking at the rear end and by means of a plug carrying the centre at the front end. The machine is traversed in the usual way in grinding the cylindrical part of the work and a formed wheel is used only to finish the profile of the nose. Two plain grinders and one formed wheel grinder handle the output of the plant. The diamond problem is overcome by avoiding, as much as possible, wide formed wheels and the men in charge express themselves as well satisfied with the results. Following the grinding, the inside of the nose is turned to size and the shells receive their preliminary shop inspection in which particular attention is given to the undercutting and waving in the groove for the band. After this the shells receive their first government inspection which follows somewhat similar lines to the shop inspection.

GENERAL VIEW OF ASSEMBLING DEPARTMENT—PLACING POWDER CASES AND TUBES, FILLING WITH BULLETS AND RESIN, WEIGHING, PLACING SOCKET, ETC.

Banding Operations.

The work in connection with the copper rotating band consists of a series of operations. The marking is done at this point upon a Holden-Morgan marking machine and the bands are crimped in place by means of a hand lever press which sets it down into the groove at four points in the circumference. The banding press is of the hydraulic six-cylinder type, built by the Canadian Fairbanks-Morse Co. So successful has this press been that the company has undertaken its manufacture, and has sold a considerable number to other people engaged in the shell business. The machine is operated by a belt-driven pump, and has a number of interesting features. The shell is placed, open end uppermost upon a small plate at the centre with the pistons working radially towards it, and the band is pressed home in two operations between which the shell is given an eighth of a turn so that the entire circumference is affected. The press is quick acting and the entire operation requires less than one minute.

The turning of the band is done on small lathes using flat formed tools. The main tool is situated on the carriage in the usual place while a smaller tool located in the centre of the carriage, so as to operate on the bottom of the work when the cross feed is reversed, is used to turn the flat parts of the band. A brass plate which acts as a rest for a hand tool is now slipped over the main forming tool and all burrs and ragged edges are removed from the turned band in this way.

Assembly.

The case of the shrapnel may now be considered finished and only requires assembling with the interior parts. These consist of the tin powder cup, the diaphragm, a brass tube leading down through the centre and which screws into the diaphragm, the bullets and rosin matrix, the cap and plug, and several bits of muslin solder, etc. The first operation consists of placing the tin powder cup beneath the steel diaphragm which was placed in the shell previous

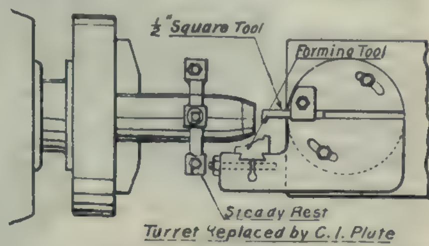
to the nosing operation. The tubes are now screwed in place and a felt plug upon the end of a wire is inserted to prevent all particles of material or foreign matter from entering the tube or the powder case. This stopper remains in place until the completion of the assembly.

The bullets are stocked above on the gallery of the shop and come down to a filling trough by gravity through a tube in the same way that the diaphragm discs come down to the nosing press. This saves a considerable amount of floor space at points in the plant which are of necessity very much congested. The spout delivers to a trough at the end of which is a filling device especially designed to deliver the bullets to the shell in a steady stream rather than in a mass. It has been the experience of the officials of this plant that this is a most important point as the space cannot be perfectly filled by the bullets if these be dumped in bodily.

SHELL VISE AND BALL-BEARING PLUG FOR SCREWING DOWN SOCKET.

To insure the bullets being thoroughly packed, the shell rests during the process upon a vibrator plate which vibrator is very similar to that used on matched plate moulding machines. Short, rapid motion has been found to give better results than a longer and slower motion. The correct number of bullets is ascertained by weighing after which the shells go to the rosin pots. The bullets are not heated as is done in many plants, this being considered unnecessary if due care be exercised in the pouring of the rosin and in maintaining it at the proper temperature. Experience and the making of sections of a number of finished shells have amply born out this practice in a very satisfactory manner.

After filling, the shells are again corrected for weight and are ready for screwing in the sockets. For this purpose, the case is firmly held in an upright position by a special vise operated by a lever and cam. The threads and seating parts of the socket are first luted with shellac and then screwed



FOX TURRET LATHE WITH TURRET REPLACED BY SET-UP FOR FINISHING SOCKETS.

home by means of a special ball-bearing driver and a large, single-ended tap wrench . The plug used for this purpose is a very simple and efficient affair. It consists of the squared shank and a straight, threaded portion of the same diameter and pitch as the inside threaded part of the sockets. Upon the upper part of the thread are two hardened steel nuts fitted with grooves on their adjacent sides to form the raceway for a ball bearing B. The bottom nut seats against the socket to be screwed in and is jammed by the upper nut on account of the much greater friction in the thread bearing than in the ball bearing. For the same reason, the backing of the wrench instantly releases the plug from

FINISHING SOCKETS ON STANDARD LATHES WITH FORMED TOOLS.

the socket from which it can be unscrewed by hand.

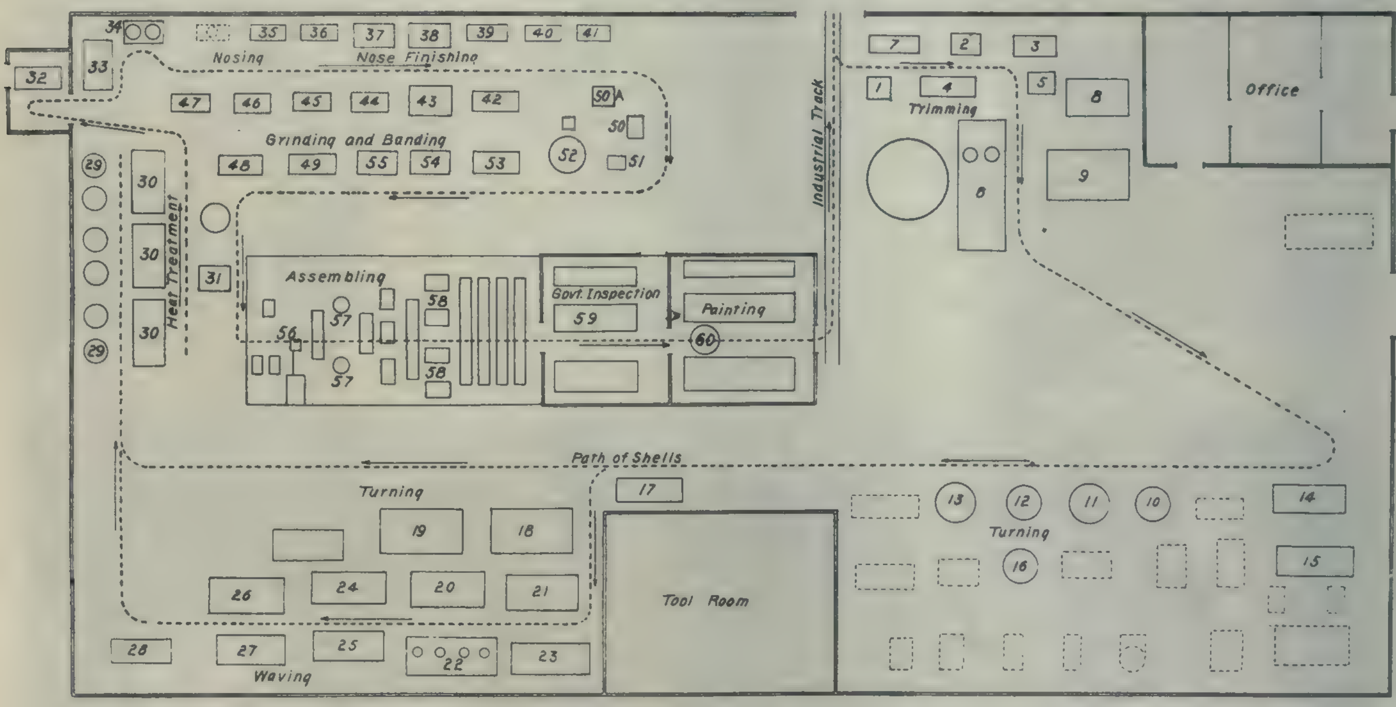
The tube is soldered to the socket by means of a special copper formed in the shape of a ring of the right size and provided with a groove on one side to allow the escape of air. The solder is used in the form of wire which is first coiled and then cut into rings, no acid being permitted in the process.

GROUP OF GOVERNMENT INSPECTORS.

Finishing the outside of the socket in conformity with the general contour of the shell nose is done on four small lathes equipped with formed tools and steady rests. These lathes remove all surplus solder and in doing this perform the last manufacturing operation upon the shells. The latter now receive their final shop inspection and are passed on to the officials of the government for their final gauging and inspection. Upon their being passed and the receipt of favorable report from the firing test, the shells are painted to prevent deterioration by weather conditions.

Tests.

It will be remembered that, at the preliminary inspection, two were chosen from each series of 120, one of which was to be prepared and sent to the arsenal for the firing proof and, from the other, a section is to be cut out as designated by the inspector for the preparation of a specimen for the tensile test of the steel. The shells are painted on a very ingenious machine designed and built by the Canadian Fairbanks-



GENERAL LAYOUT OF PLANT ILLUSTRATING PATH OF PRODUCT AND A MOST EFFICIENT SYSTEM.

TRIMMING.

1 -Pipe machine.
2 Rogers bolt cutter.
3 Bertram lathe.
4 -Niles lathe.
5 -Hall bolt cutter.
6 Ingersoll miller.
7 Bertram lathe.
8 Ingersoll miller.
9 -Double spindle boring machine

BORING.

14 Horizontal boring mill.
15—Horizontal boring mill.
21 Conradson turret.
22 -Foote-Burt 4-spindle drill.

WAVING.

24 --American lathe.
25 Bertram lathe.
26 American lathe.
27 Bertram lathe.

TURNING.

10 Bullard mill.
11 Bertram mill.
12 Bullard mill.
13- Bertram mill.
16—Bertram mill.
17- American turret.
18 Steinle turret.
19 Steinle turret.
20 Pratt & Whitney turret.
23 Gisholt lathe.
28 Small lathe turn for nosing.

HEAT TREATMENT.

29 Six Fairbanks-Morse oil furnaces.
30 Three oil tanks.
31 Scleroscope.
32 Fairbanks-Morse sand blast machine.
33 Nosing press.
34 -Fairbanks-Morse furnace.

FINISH NOSE.

35—Lathe, tap and face.
36 Lathe, tap and face.
45 -Lathe, tap.
46—Lathe, turn profile.
47 Lathe, turn profile.
48 -Lathe, turn profile.

GRINDING.

37 Norton grinder- grind body.
38 Norton grinder -grind body.
43 Norton grinder -grind body
44 -Norton grinder grind profile.
Lathe, bore nose profile.
Lathe, bore nose profile.
41 Lathe, file profile when necessary.
50 Marking machine.
50A Waxing machine.

BANDING.

51 F.-M. hand press set band.
52 -Fairbanks-Morse banding press.
53 -Small lathe turn band.
54 Small lathe--turn band.
55 -Small lathe turn band.
49 Small lathe turn band.

ASSEMBLING.

56 Bullet spout.
57 Rosin pots.
58 Four Fox turret lathes, turn socket.
59 Inspection benches.
60 Fairbanks-Morse painting machine.

Morse Co. This machine like the banding press is being constructed in numbers and sold to other shell manufacturers. It contains six vertical spindles spaced evenly about a flat circular table. These spindles are kept in constant rotation at a speed of about 250 r.p.m. by a motor at the base and which receives its current through a lamp socket from the ceiling. The shells are placed in an inverted position upon the upper ends of the spindles, the friction being amply sufficient to drive them with the necessary force. The painting is done with a flat pad from paint receptacles conveniently attached to the machine. The table revolves upon ball bearings and the whole is on wheels so that it can be readily moved to the work. The time required for the painting is one minute per shell for the three coats as specified by the government.

The shells are removed from the machine with a special holder that grips them by the copper band and are placed in racks to dry. After the painting is completed, the shells are finally inspected and packed in wooden cases holding six each. These are loaded upon an industrial railway car and taken to the shipping department whence after inspection of the cases, they are loaded into railway cars two tiers high and start upon their long journey to France, and after loading with the powder charge and primer, to the battle fields.

System a Factor.

The most striking point in connection with this plant is the evident perfection of the system employed. From the moment the forgings reach the plant, not a backward movement is made. The flow of the shells through the plant is smooth and uninterrupted and at no point do the streams cross over. The result of this is evident. Foremen and superintendents are conspicuous by their absence in the shop and are to be found in the office attending to business.

The transfer truck and pyramid system is used almost entirely and the shells are unloaded upon the floor only where absolutely necessary. Another striking feature is the utilization of all the machinery of the plant both great and small, the devices to this end being in many cases original.

PAINTING, FINAL INSPECTION AND CRATING.

The company has bought little if any outside machinery. On the contrary, the special machines required have been designed and built within the plant and many have been sold to outsiders. The co-operation of Canadian manufacturers in assisting each other in this and in other ways has not only been the surprise of the business to foreign companies, but has been perhaps the greatest factor in the successful handling of this great work by Canadian financiers and manufacturers.

SHIPPING AND RECEIVING DEPARTMENT LOADED INDUSTRIAL MOTOR CAR.

List of Operations Required.

1—Length and basing.
2—Outside turning.
3—Boring.
4—Waving and undercutting.
5—Turn for heading.
6—Heat treatment.
7—Sand blast.
8—Heading.
9—Rough turn nose.
10—Bore and tap nose.
11—Grind body.
12—Grind nose.
13—Turn inside nose.
14—Preliminary shop inspection.
15—Marking.
16—First Government inspection.
17—Press on band.
18—Turn band.
19—Assemble.
20—Turn Socket.
21—Final shop inspection.
22—Final Government inspection.
23—Painting.

VARNISH TREATMENT OF LYDDITE SHELLS.

By D. B. H.

FOLLOWING the article by the writer in your Shell Number of March 18, on the heat treating of shrapnel shells, the attention of those engaged in the manufacture of lyddite shells is drawn to the fact that there has been developed an automatic electric oven for the purpose of baking the varnish which is placed on the inside of these projectiles.

The oven is constructed of steel angles and channels in combination with special heat insulating material. The door opens flush with the floor and is raised by a balance weight from the rear so as to readily permit the laying of tracks into the oven, on which the shell trucks may be run. The heating elements are conveniently placed in the bottom of the oven between and underneath the tracks. The current is fed to the heating elements through a thermally controlled switch arranged to turn the current off or on as required, so as to maintain a constant temperature in the oven without attention from the operator. This results in a very considerable saving of current, for as soon as the proper temperature, 300° F., is reached, the current is automatically cut off, and, as the oven walls do not radiate the heat, it takes a considerable time for the baking shells to lower the temperature 2 or 3 degrees, when the current is again automatically turned on for a few minutes to bring the temperature back to the required point. This gives an oven which, besides producing the best results in baking, can be operated with the greatest economy and speed

BRITISH GUNNERS MOVING HEAVY PIECES OF ARTILLERY.

FIRING A SUBMERGED TORPEDO.

THE main armament of a large warship consists, as everyone knows, of guns; but it is not so generally known that the submerged torpedo tube is a part of the auxiliary armament of every large war vessel. The battleship's torpedo tube is always situated well below the waterline, and it is fixed relative to the ships. In the earlier submerged tubes efforts were made to train them, but the idea involved so many complications that it was abandoned, and fixed tubes are now universally fitted.

The Torpedo Tube.

The torpedo tubes themselves consist of a cylindrical vessel, one end of which is attached to the ship's side, and fitted with a sluice valve. The tube is loaded either through the end, or, as in most of the later types, at the side. Elaborate arrangements are provided to prevent the possibility of the torpedo being discharged until the valve at the ship's side is open, and the tube is in communication with the sea. It is also impossible to open the end door of the tube, if the sluice valve is not shut.

Discharging the Torpedo.

The torpedo is discharged from the tube either by means of compressed air, cordite, or powder. If the ship were travelling at a high speed when the torpedo is fired, the nose of the latter would be twisted round, and its tail would probably jam in the valve. To prevent this, a bar or spoon is made to project out from the ship's side to guide the torpedo until it is clear of the hull. This bar is either run out just previous to firing, or else it is fired out at the same time as the torpedo, and returns automatically after the torpedo has left.

To discharge the torpedo at the right instant, it is obvious that the firing must be done some distance from the tube itself, from a position where the target can be observed. A firing director is usually fitted in the conning tower. This consists of a sighting device and a firing key. At the right instant the key is pressed, and an electric current does the rest. The firing director is provided with arrangements for making the necessary allowances for the estimated speed and course of the enemy, and the speed of the torpedo itself, the latter being different for different ranges.—Liv. Journal of Commerce.

ENGINEERING AND ARMY SUPPLIES.

MOST interesting corroboration comes in a despatch from the "Eye-Witness" present with the British General Headquarters, concerning the part played by engineering workers in maintaining the supplies to our Army in the field.

A good deal has been said at different times about the way in which our troops are supplied. It is possible, however, that by some of those who are not conversant with military phraseology the term "supply" may be taken to be applicable only to the feeding of an army. This is not the case, for essential as is food, its provision is only one part of the problem of maintaining a force in the field. To be efficient as a soldier a man requires more than the adequate nourishment of the body.

The Different Branches.

The scope of the branches into which the whole subject of supply is divided is somewhat complicated, and can not be accurately explained in a few words, for these branches are not all exactly defined, and in some cases overlap. It may be said that the furnishing of food of every kind for man and beast is the duty of the Army Service Corps, the furnishing of every drug and appliance necessary for the treatment of the sick and wounded is carried out by the Royal Army Medical Corps, assisted by the various voluntary organizations, which started their effective work when war began, while the provision of stores for disabled animals falls to the Army Veterinary Department. The Royal Flying Corps purchases its own machines, as does the Mechanical Transport Branch of the Army Service Corps. Broadly speaking, however, with these exceptions, the Ordnance Department supplies the Army with all the clothing, equipment, arms, ammunition, tools, appliances, machinery and expendible material that can be required, from guns weighing many tons to tin-tacks.

Vastness of the Work.

The vastness of the work of maintaining the army—apart from feeding it—may be gauged from a few figures. In one month there were issued to the troops 450 miles of telephone wire, 570 telephones, 534,000 sandbags, 10,000 lb. of dubbin for boots, 38,000 bars of soap, 150,000 pairs of socks, and 100,000 pairs of boots. In ten days the number of fur waistcoats given out amounted to 118,160, while during the same period 315,075 flannel belts were distributed. The way that insignificant items mount up where large numbers of men are concerned is shown by the fact that the weight of the average weekly issue of vaseline for the feet is 5 tons, and that of horseshoes 100 tons.

Vocabulary of Stores.

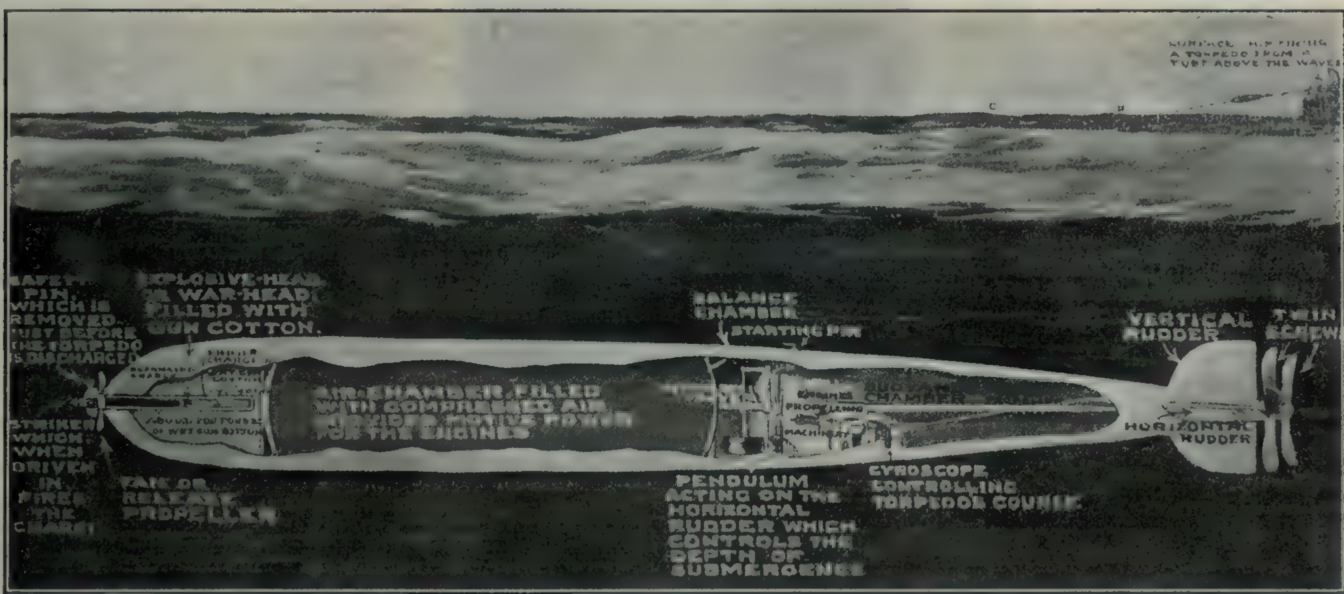
On the other hand, some idea of the complexity of the work can be gathered by reference to the official "Vocabulary of Stores" which corresponds to the price-list of a large shop, and contains 50,000 separate items. The different patterns and varieties of the same article

stocked is also somewhat surprising. For instance, there are several hundreds of kinds of spanners in use in the Service, spanner No. 203 being listed as required for "gland and valve of cap securing inner chamber of air-cylinder and filling valve, spindle intensifier; barbette, B.L., 9.2-in., Mark IV., also filling and emptying valve gland air-cylinder; barbette, B.L., 9.2-in., Marks V. to VB." Even such unusual demands have been made as those for bitter aloes—to put on head-ropes to prevent horses biting them—and permanganate of potash for dyeing grey horses brown.

Not only is the variety of the stores used greater than it was formerly, but each article tends to become more complicated in itself. Guns, and their mountings and carriages, and ammunition, with its delicate fuses, the handling of which originally formed the chief duty of the department, are, of course, far more it, and of accounting for it afterwards. In most cases the articles used by the Army are made either in Government or private factories at home; but some are manufactuerd by the Ordnance Department in its own workshops in France.

In the case of anything of a mechanical nature, the duties of the "Ordnance" are not finished when the article is handed over to the troops who use it, for it is still carefully watched, gauged, and tested, maintained in order, and, if necessary, repaired or replaced. The importance of this work in connection with guns, ammunition, or explosives needs no emphasis. To carry on, indeed, the officers and men of the department must not only possess a knowledge of their own work, but have to be well acquainted in the establishments, formations, and requirements of every kind of unit. For the testing and repair of machinery there is a specially and technically-trained staff must be taken out and delivered to them. This, of course, applies equally to the question of food; but there are two points which make the distribution of ordnance stores less easy than that of food, and that is the variety of the former and the fact that some of them have to a certain extent to meet special requirements.

Briefly, the procedure adopted to ensure that the troops receive promptly what they need is as follows:—For all ordinary stores for which there is a steady demand, and of which an estimate of requirements can be framed in advance, the ordnance officer with a division sends down to the base—which is really a depot or reservoir of stores—an order for a week's supply made out in anticipation. If this order were complied with at one stroke, and the whole of the week's supply sent up in one consignment by rail from the base to rail-head—the point where railway transport ceases—the result would be congestion and confusion, for the mass could not be handled and sent out to the troops at once, nor could it be stored where it was unloaded. Moreover, it might happen that the troops would not at the moment be in a position to take delivery of the stores for which they had asked. From the base, therefore, a proportion of the weekly demand is sent up to railhead daily, and from this amount the divisional ordnance officer is able to satisfy each day part of the current requirements of the units.



CHIEF WEAPON OF THE SUBMARINE THE TORPEDO, ITSELF A SMALL AUTOMATIC SUBMARINE.

The machinery for super-heating air, which has increased the range of the torpedo to so considerable an extent, is not shown in the diagram, as it is a secret. The letters at and near the surface ship refer to the following:—A—Safety pin removed just before the torpedo is discharged. A to B—Delay action check is placed on the engine during pasage from A to point of striking water, B. At B the water turns the fan, or release-propeller. At C the fan is fully unscrewed, and the striker-rod is free to act after a small pin (a third safety-check) has been broken by the striker being driven in by impact with the object attacked. From B to C is forty feet.
—Cut and Data, Courtesy "Illustrated London News."

elaborate than they used to be, as are the electrical instruments used by the engineers for telegraph, wireless, and telephone—the employment of which has to such a large extent superseded the old simple flag and lamp signalling and heliography. Even such things as water-carts are now fitted with an elaborate arrangement of filters.

Supply and Maintenance.

The duties of the department can be divided into those of supply and maintenance. The first consists of estimating betimes what will be required, of framing scales of issue and checking demands for it, of ordering, procuring, and testing or making it, of providing the troops with of officers, warrant officers and men, and stationary and travelling workshops, whilst all armourers, whether employed in the ordnance workshops or with regiments belong to the department.

Distribution.

It must be remembered that since the units of an army on active service are either fighting, or waiting ready to fight, and are therefore scattered over a large area, the problem of distribution, whether it be of food, ordnance stores, parcels or letters, is bound to be one of great difficulty. It is in most cases impossible for the soldiers to go collectively or individually to some central depot or shop, where they can draw what they want. The stuff

Two great principles which are strictly adhered to are, on the one hand, not to unload from the rail, and accumulate a stock at a temporary point, such as railhead, where it cannot be handled, and,

on the other hand, not to lock up railway rolling stock by keeping trucks under load. To avoid a block, therefore, it pays to send back to the base the unexpended balance of a day's consignment which is not issued to troops on arrival at railhead.

Intermitten Demand System.

For all technical stores for which there is not a steady demand and which are not required in bulk the system is different. The divisional ordnance officer wires to the base to send up from stock at once whatever is required. Once on rail, ordnance supplies follow the same channel of delivery as the food. Up to railhead they are conveyed on special trucks in the supply trains and thence by motor transport to the refilling stations, whence they are taken up to the fighting line in the horsed vehicles of units. So far as the ordnance is concerned, the base, besides being a depot, includes huge workshops.—Engineering.

MINES AND MINE-SWEEPERS.

By G. J. W.

ONE frequently sees in the daily press during these troublous times the statement, "Struck a mine—sank in a few minutes," followed by the name of the ship, her value and that of her cargo, and the fate of the passengers and crew. The many such happenings of this nature serve to indicate the important role being enacted by the submarine mine in the present war.

The first appearance of the submarine mine was during the revolution of Britain's American Colonies, when it was described as an "infernal machine of Yankee introduction," outraging all the principles of warfare.

David Bushnell is credited with the conception of the idea and, in order to put the mine to a practical use, designed and constructed one of the first attempts at a submarine boat. The boat was nearly egg-shaped, with room enough to contain a single operator. He propelled the machine by means of treads, which conveyed the foot power to a couple of paddle wheels on the outside. The idea was to approach close enough to an enemy ship usually at anchor, with the minimum possibility of detection. The mine was simply a large keg filled with gunpowder, ignited by a fuse, and so attached to the exterior of the "submarine" as to be easily detached by the operator at the critical moment, the fuse being timed to allow the submarine time to escape the effects of the explosion.

The scheme was certainly clever in conception, but lacked effectiveness at the practical test, as not a single ship was destroyed, and for the time being the mines became a standing joke in the incident known as the "Battle of the kegs," when Bushnell let loose a flotilla of his mines at the British fleet in Philadelphia harbor. The ships were so manoeuvred that their gunners were able to destroy the mines without loss to themselves. The British navy was considerably affected by this invention, and although not a single ship was lost, it can be considered a creditable result that the morale of the fleet was at least upset.

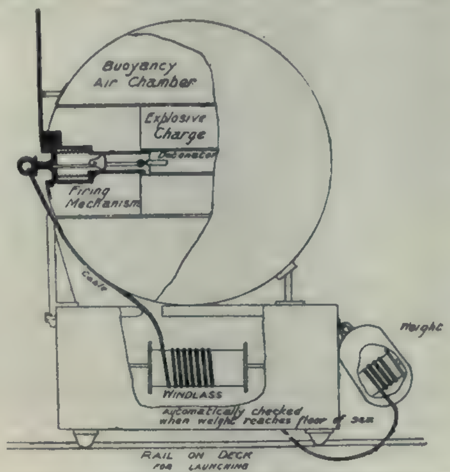


FIG. 1. SECTION OF MINE SHOWING METHOD OF OPERATING.

When Bushnell gave up his efforts, Robert Fulton took up the machine, but after spending much time and money in improving it, he was unable to interest France, England and the United States respectively, eventually giving up the mines and torpedoes to turn his attention to the steam engine. Eventually Samuel Colt perfected a scheme to explode fixed mines by electricity, and this brought the mine into use for harbor defence. The British used this mine in blockading Sevastopol during the Crimean war, and in the American Civil War they were used by the South against the Northern gunboats on their rivers.

After this, European nations took up the manufacture and, incidentally, improvement of the mine, thereby making it not only effective but also a legitimate weapon in warfare. It does not, however, seem to have been fully appreciated until the Russo-Japanese War, where its scope was widened from the limits of defensive warfare to offensive work against the enemy in open waters. Considering the smallness of the fleets engaged, the loss of 14 Russian and 10 Japanese warships was enormous, and at the time placed the mine far in advance of torpedo work. Since then, the floating mine on the high seas has been used as a method of offence, but it has the uncertainty of hurting friend and foe alike, becoming immediately a menace to all when once it is sown.

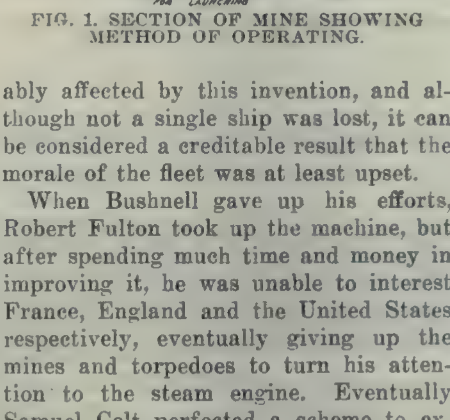


FIG. 2. ARRANGEMENT FOR ANCHORING MINES.

In 1907, before the Hague Convention, the British delegates proposed a rule prohibiting the laying of mines on the high seas, with the exception of permitting belligerents to lay them within a zone of 10 miles from the shore off any naval ports, shipbuilding yards and graving docks, providing due notice was given to neutrals and steps taken to prevent merchant ships being exposed to danger. The proposal was not accepted, and we have seen in the present war what the effect has been.

Most of the mines used are contact mines, and consist of the mine itself, as shown in Fig. 1. A lever is so placed as to explode the charge, while the anchor chamber with attached weight is so arranged as to pay out sufficient cable to maintain the mine at a proper distance below the surface. Fig. 2 shows how a mine adjusts itself after being dropped overboard. The anchor chamber pays out cable, and sinks until the weight reaches the bottom. This checks the cable's unwinding and pulls the mine below the surface.

The only possible defence against mines is countermining and sweeping. The former is carried out by detonating high explosives amongst them and setting them off. The more effective method, however, is removal altogether by "sweeping" operations, which are carried out usually by vessels of light draught. In the present war, steam trawlers and herring drifters have been pressed into use, and have given a good account of their capabilities for the work, although they have by no means been allowed to do so without numerous disasters and loss of life to those on board.

Two vessels proceed through the mine field abreast of each other, say, from 100 yds. to 200 yds. apart, and drag over the mine field a length of heavy chain or wire, which is connected at its ends to the two mine-sweeping vessels. The chain, as it is dragged over the bottom, engages such mines as lie in its path, which are destroyed by contact with each other or by a few well-directed shots from the vessels of the mine-sweeping fleet. The fleet usually consists of six vessels, working in three pairs and under the charge of a commodore.

G.T.R. APPRENTICES' BANQUET.

AT the third annual dinner of the apprentices of the motive power department of the Grand Trunk Railway System, Montreal, on the evening of April 16, about 200 apprentices, and men who had been apprentices, were present together with a number of prominent officials of the Company.

A. A. Mavor, master mechanic, took the chair, and amongst those at the head table were Brigadier-General Bertram, R. S. Logan, H. R. Safford, J. Pullen, D. E. Galloway, J. Burrows, R. Patterson, W. D. Robb, T. McHattie, J. Markey, J. R. Donnelley, C. Manning and James Powell.

The toast of "The Grand Trunk Railway System and Its Apprentices," was proposed by Brigadier-General Bertram, of Dundas, who dealt in his address with past days, when no such training system was in force, and showed the benefits that were being given both the employees and the company by the present system.

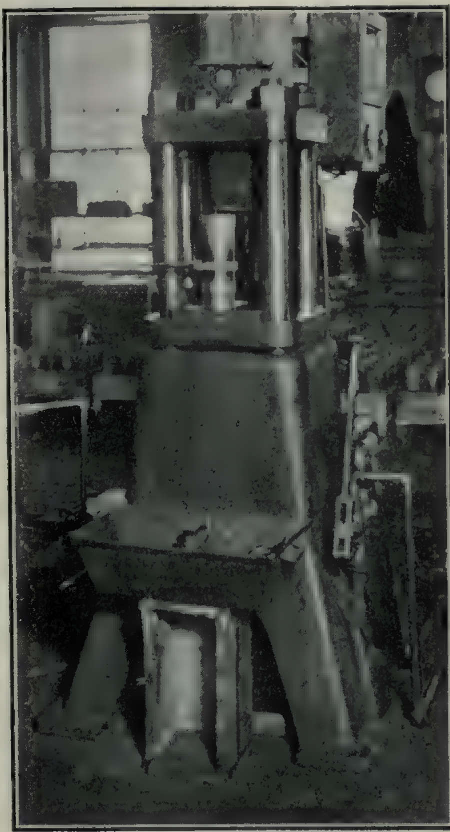
Vice-President R. S. Logan was the first to reply to the toast, and he remarked that the Grand Trunk Railway apprenticeshop system was the best on the continent, and was producing the best results.

W. D. Robb, superintendent of Motive Power, who has had much to do with the work of the apprentice system, followed, and complimented the young men on the manner in which they had arranged the banquet. Other roads, he said, occasionally gave banquets to their employees on the completion of an important piece of work, but it was a unique affair on any railway in America, outside of the Grand Trunk, for such employees to banquet their officials, and for the officials to attend and encourage the younger men to go on with their work.

E. H. MUMFORD DEAD.

E. H. MUMFORD, very prominent and well known in the molding machine manufacturing industry, died on April 18 at his home in Plainfield, N.J., following a short illness. Mr. Mumford was born in Groton, Mass., 52 years ago. He received his education in New England, graduating in 1886 from the Massachusetts Institute of Technology. In that year he was one of six members of the graduating class who were selected by Charles Francis Adams, of Boston, to serve a course of training in the shops of the Union Pacific railroad.

In 1890, Mr. Mumford left railroading to take a position as foundry superintendent of the Henry R. Worthington steam pump foundry, then located at Elizabethport, N.J. Some time later, Mr. Mumford became the New York representative of the Bement-Niles Co., Philadelphia. About 1895 he went into partnership with Harris Tabor to form the Tabor Mfg. Co., which engaged in the manufacture of moulding machines designed by Mr. Mumford. These machines for several years were made at



GOLDIE & McCULLOUGH CO. NOSING PRESS.

the plant of Samuel L. Moore & Sons Corporation at Elizabethport.

In 1900, this business was moved to Philadelphia and Mr. Mumford remained identified with it until 1905, when he left the Tabor Mfg. Co. and formed the E. H. Mumford Co., which also located in Philadelphia. In 1909, the E. H. Mumford Co. was sold to the Mumford Molding Machine Co., and of the latter company Mr. Mumford was vice-president and general manager until last November.

Since then Mr. Mumford had revived the E. H. Mumford Co. and made arrangements once more for the manufacture of molding machines at the plant of Samuel L. Moore & Sons Corporation, at Elizabethport. The business will be continued by E. W. Mumford and T. J. Mumford, who are, respectively, vice-president and secretary of the E. H. Mumford Co.

HYDRAULIC BANDING AND NOSING PRESSES.

THE two hydraulic presses herein described and illustrated are built by the Goldie & McCulloch Co., Ltd., of Galt, Ont. The nose press is designed for nosing shrapnel shells up to 18-pounder size, and is a vertical press of the four-post type, with one 10-in. ram of 2⅝-in. stroke, and designed for pressures up to 1,200 lbs. per square inch, or 47 tons on the shell being treated. The cone-shaped nose die is fitted to the upper platen, and the shell is placed on the top of ram, which forces it up into the upper die, thus forming the nose. The capacity of this unit is about 60 shells per hour.

The banding press is designed for compressing the copper bands on shrapnel and other projectiles up to 4.5 in. diameter, and is circular in form. The outside ring at the back of the rams is a steel forging. The press is fitted with 6 rams, each of 8-in. diameter by ½-in. stroke, and designed for pressures up to 1,200 pounds per square inch. The resulting load on each ram is 30 tons, or a total for the six rams of 180 tons. The dies are circular, and are made suitable for all widths of band. The capacity of this press is about 100 per hour.

GOLDIE & McCULLOUGH CO. BANDING PRESS TOP VIEW.

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Vol. XIII. APRIL 29, 1915 No. 17

PRINCIPAL CONTENTS.

SHELL PRODUCTION—CANADA'S RESPONSE.

THROUGH the courtesy of the Canadian Shell Committee and the managements of various engineering establishments, we have been enabled to feature what we believe to be a fairly comprehensive resumé of shrapnel shell processes, operation methods and devices, etc., practised in representative Canadian plants.

We have to thank the staff officials of the different concerns for their co-operation in accumulating the necessary data, and very especially the staff photographers of two of plants for the excellent and high-grade work they produced to our requirements.

Arrangements have been made to continue publication of a series of articles dealing with the shell industry throughout the Dominion, and in our May 6 issue will be found a comprehensive descriptive article covering Shrapnel Shell Manufacture in a Canadian Structural Engineering Works.

In the present instance the inception of the shell has been dealt with only as far back as the steel bar, but on May 27, we will go still further and trace by letter and picture the various processes from the iron ore to the Canadian completed shell.

CO-OPERATION NOW—THEN?

IT has long been a maxim of war that one way of defeating an enemy is to prevent him from winning. This principle, in a modified form, has also been a policy of too many manufacturing institutions who apparently believe that their success is best assured by preventing the other fellow from succeeding. The call of Empire in its hour of external danger not only to soldiers but to mechanics and engineers has, for the time being, changed or obliterated entirely all such sentiment.

A number of contributory causes have brought about this very desirable result. The development of the means of attack in which vast numbers of shells are employed to conserve the lives of soldiers has raised the work of the mechanic who makes them to the highest plane. There is work of this kind for all to do and what cannot be done within the Empire must be done by others and paid for. The manufacture of shells is new to the men of our peace-loving Dominion, and manufacturers both great and small have felt the need of knowledge and experience which only co-operation can provide.

This unity of effort has taken hold and has been so complete that the Canadian output of munitions of war has already exceeded the original estimates of the country's capabilities, yet little more than half of our capacity has been reached. No complaint as to the quality of the shells has been heard and British representatives have not been sparing in favorable comments. This co-operation has not been confined directly to the making of shells, but has extended to the building of a large part of the special machinery employed which in most cases has been original in design and eminently successful in operation.

The feeling of interdependence and mutual help which has made possible the attainment of such remarkable results by hurriedly converted plants could be relied upon to accomplish more or less similar success if continued in times of peace. Hundreds of managers, superintendents and foremen have become more favorably known and disposed to each other through the shell business, and from this source alone will doubtless develop a disposition to still further intensify the spirit of industrial fellowship. Esteeming some such eventuality in the light of a by-product of the war, we might almost consider the latter in spite of its horrors, tragedies and bereavements to have been none the less "worth while."

Representative of Canadian manufacturers, their families and administrative staffs who have heeded the call of Empire for active service on our various overseas contingents.

LIEUT.-COL. A. J. OLIVER,
General Manager, the R. McDougall Co., Galt, Ont.

CAPTAIN F. R. NEWMAN,
Sales Manager, Canadian Fairbanks-Morse Co., Toronto.

LIEUT.-COL. J. A. CURRIE,
President Imperial Steel & Wire Co., Collingwood, Ont.

PRIV. LENNARD BERTRAM,
Son of Henry Bertram (Sec.-Treas.) the John Bertram & Sons Co., Dundas, Ont.

CAPTAIN TRUMBELL WARREN,
Late President Gutta Percha & Rubber Co., Toronto, killed in action.

LIEUT.-COL. WILLIAM HENDRIE,
Vice-President, the Hamilton Bridge Works, Ltd., Hamilton, Ont.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3.....	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain..	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill....	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 50
Copper, unch-bled, heavy	12 00	12 50
Copper, wire, unch-bled.	12 00	12 50
No. 1 machine compos'n	10 00	10 50
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel....	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings.....	9 50	10 00
No. 1 brass turnings....	7 00	7.50
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	64	47	....	....
½ in.	69	56	....	....
¾ to 1½ in. ..	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in. ..	74	61	73	60
4½, 5, 6 in. ..	....	....	72	59
7, 8, 10 in. ..	....	....	68	56
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in. .	68	57	....	....
2, 2½, 3 in. ..	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in. ..	....	....	67	57
4½, 5, 6 in. ..	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2 in. ...	44	34	....	....
2½ to 4 in. ..	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	41	....	....
½ in.	63	50	....	....
¾ to 1½ in. ..	68	55	....	....
2 in.	68	55	64	51
2½, 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in. ..	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws....	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ..	$18 75	$19 50
Electrolytic copper	18 50	19 25
Castings copper	18 00	19 00
Tin	52 00	50 00
Spelter	14 00	13 00
Lead	5 50	5 75
Antimony	28 00	30 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$20 00
Openhearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass.....	35 p.c.
Nuts, square, all sizes..	4¼c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above.......	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.75
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.73
Linseed oil, raw, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. (galvanized	4 50	4 50
Queen's Head, 28 B.W.G.	4 60	4 60
Fleur-de-Lis, 28 B.W.G.	4 30	4 30
Gorbal's Best, No. 28	4 60	4 60
Viking metal, No. 28	4 20	4 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., April 26, 1915.—General market conditions are rather quiet, opening of navigation improvement rather counteracted by depressing war news of casualties, etc. Steel if anything moving a little better, due to shell consumption and slight activities in railways. Prices of pig iron stationary. Metals rather active.

Steel.

Building sections quiet, with perhaps slight improvement. Machinery steel and merchant bars also moving more freely, due to shell manufacture. The Algoma Steel Co. has secured an order of 7,000 tons of rails from the Kansas City Southern Railway. The details of price, shipment, etc., are not yet settled, but order is officially announced. Steel companies are taking a large interest in the manufacture of shells, and the tendency is for them to co-operate with the machine shop in the matter of heat treatment, as the greatest stumbling block to shell manufacture seems to be in this feature. Tool steel companies report fair business; Armstrong-Whitworth Co., for instance, being very busy making tools.

Pig Iron.

Market quiet and prices unchanged.

Machine Tools.

Much activity continues in machine tools, new and rebuilt, for the manufacture of shells. Jigs and fixtures are being put on the market by manufacturers of machine tools in great profusion, but otherwise business is very quiet. The supply business is good, and shows a developing tendency.

Metals.

Copper has gone away up in price, due to demand for war munitions. Ammunition orders, it is believed, will continue to be placed for six months to a year after the war to fill up depleted stocks. When the war stops, the demand for copper for commercial uses will continue; hence price rise likely to be maintained.

Tin.—Position unchanged; enough in America to supply immediate demands. Price tendency to stiffen.

Spelter.—Increasing demand has sent up price.

Lead.—Supply plentiful for present; price easier as a consequence.

Antimony.—Scarcity being felt more and more, and price rising.

Aluminum.—Quiet, with price unchanged.

Toronto, Ont., April 27, 1915.—There has been little change in the general industrial situation during the week. In some respects the seasonable weather has had a beneficial effect on trade, but, generally speaking, business is quiet except for war orders, which are keeping a goodly number of factories busy. Many engineering plants are working at full pressure on shells, and the number engaged in this work is steadily increasing. Orders of considerable size have quite recently been distributed among firms in the West, including Vancouver and district. This practically means that every plant in Canada capable of undertaking the work is, or at least soon will be, engaged in the production of shells. In the aggregate, these orders for shells placed in Canada since the beginning of the war represent an expenditure of over eighty million dollars. This will naturally benefit the companies concerned, and help to make up for the loss of business through the ordinary channels.

A new line of action so far as Toronto is concerned, to attract new industries, has been proposed. It is suggested that a committee be appointed, consisting of representatives of the city, Harbor Commission and Board of Trade, to plan and organize a campaign to that end. In this respect Toronto is following the lead set by other cities, which have been in the majority of cases successful in their efforts.

Steel Market.

Conditions in the steel trade do not show any material change except for the increasing demand for shell forgings and rounds for high explosive shells. This business is keeping certain departments actively employed. As regards ordinary business, the outlook is a little more hopeful, and a gradual improvement in the steel trade may be expected to take place. Prices are firm, Pittsburg prices for bars, plates and shapes having advanced to $1.20.

Pig Iron.

Dull conditions continue in the pig iron market, and the outlook shows no signs of any immediate improvement. Foundries are quiet and operating at considerably reduced capacity.

Machine Tools.

The situation at present as regards shell machinery is a question of supply and demand, in which the latter is greater than the former. Any suitable machine, new or second-hand, is being snapped up. Dealers are doing all they can to deal with the situation, but are seriously handicapped by slow delivery, many machine tool manufacturers having their output contracted for months ahead. Business has been rather quieter lately, but dealers report having received some nice inquiries from prospective manufacturers of shells. As the number of firms engaged in this business is increasing, there will no doubt be continued activity in machine tool circles, more especially for machines for high explosive shells, such as lathes and high duty drilling machines.

Supplies.

There is a more active demand for supplies, business showing considerable improvement. There are no price changes of importance to note except linseed oil, which has advanced 2c, and is now quoted at 80c, with the market firm.

Scrap Metals.

There is a fair demand all round for scrap, but more particularly for copper and brass scrap. Prices are firm, but unchanged.

Metals.

There is a noticeable improvement in business, principally in those metals being used in the manufacture of war munitions. Copper, spelter and antimony have all advanced on heavy demand. Tin is easier, and has declined 5c. Quotations, however, are nominal.

Copper.—The market is very strong, and the demand for this metal for war purposes has assumed large proportions, and is still increasing. Copper has advanced 1¾c, and is now quoted at 19½c, with prospects of higher prices.

Tin.—The situation is unchanged, the market still being in an unsettled condition. The market for spot metal is easier, but quotations are entirely nominal at 50c per pound.

Spelter.—The market is excited and prices higher. There is no improvement in the situation, and supplies of spelter are still difficult to obtain. Quotations are nominal at 13c, being an advance of 1c per pound.

Lead.—The lead market is unchanged and dull. Quotations are unchanged at 5¾c per pound.

Antimony.—The heavy demand for antimony for war munitions has created a very strong market. The price of this metal is over five times what it was a year ago. Surplus stocks have already been liquidated, and the demand is increasing which points to still higher prices. English brands are scarce and prices entirely nominal. Antimony has advanced 5c, and is quoted locally at 30c per pound.

Aluminum.—The market is steady and quotations unchanged at 23½c per pound.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

TENDER forms and specifications have been forwarded by D. H. Ross, Trade Commissioner at Melbourne, for equipment required by the Victorian Railways. These tender forms have not yet come to hand, but when received they may be inspected by interested Canadian manufacturers at the Department of Trade and Commerce, Ottawa. (Refer file No. A 1435). Particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:—

28,391.—Sept. 15—1-7 ton crane locomotive engine.

28,391.—Sept. 15—1 set of working drawings for crane locomotives.

The departure of mails from Vancouver and San Francisco are indicated thus:—

From Vancouver July 9, due Melbourne August 6.

From San Francisco August 3, due Melbourne August 24.

Requirements for Queensland Railways.

Copies of indents forwarded by the Queensland Railway Department, Brisbane, to the Agent-General for Queensland in London have been furnished by D. H. Ross, Trade Commissioner at Melbourne, and are open for the inspection of Canadian manufacturers at the Department. (Refer File No. A 1435.) Particulars of the indents are outlined as follows:—

Line No.	Particulars.
1	27 copper plates.
2	Copper rod.
3	3,000 copper-coated solid drawn steel tubes.

Shrapnel Shell Manufacture

Shell Department of a Structural and Bridge Works

Staff Article

A plant devoted to fabricating and erecting structural steel is not such as we would expect to make a tremendously successful showing on the production of machine tool work requiring adherence to imposed comparatively close limits. That we have a structural steel plant equal to the latter task will be quite apparent from a study of the accompanying article.

CONCURRENTLY with the growing demand, all manner of iron and steel working industries have effected alterations in their machine shops, whereby shrapnel shells can be rapidly and economically manufactured in quantity as desired. The fact that many plants have been busily engaged in such work has been more or less generally known; at the same time, little information as to the equipment layout and the machining and other processes have been available. Shops engaged in the production of shells are, generally speaking, operating very efficiently, and much ingenuity and resourcefulness has been displayed by those responsible for their administration and organization.

Particularly do these remarks apply to the shell department of the plant here described and illustrated, because there is a vast gulf between the work of fabricating and assembling bridge girders, columns, beams, etc., and the delicate operations required in the machining of shrapnel shells.

General.

The equipment has practically all been purchased for this particular work of machining shrapnel shells, and by referring to the general layout plan the operation routine can be traced. The blanks are not forged in this plant, but are obtained from outside sources. A large number of the operations are performed on flat turret lathes, and these are equipped so as to secure that the particular objectives be accomplished in three series of operations. The finishing operations are performed either by grinding or finish turning on engine lathes. The turning of the copper bands and the finishing of the brass sockets are simple lathe operations, and are accomplished on lathes of various types and makes, which have been available on short notice.

Perhaps the easiest way to appreciate the completeness of this particular installation is to follow a shell throughout its course from the forging to the finished product.

Cutting-off and Rough-facing.

The first operations are cutting-off the open ends and rough-facing the blank ends of the shell. These operations are accomplished on machines that were formerly Hall, Brantford, thread-cutters, and have been refitted to do this work. The shell is slid on to a universal chuck and pushed in, until a stop is reached, which stop enters the hollow centre of the shell and comes in contact with the inside bottom of it. The cutting-off operation is accomplished by two tools working towards the centre. Both tools

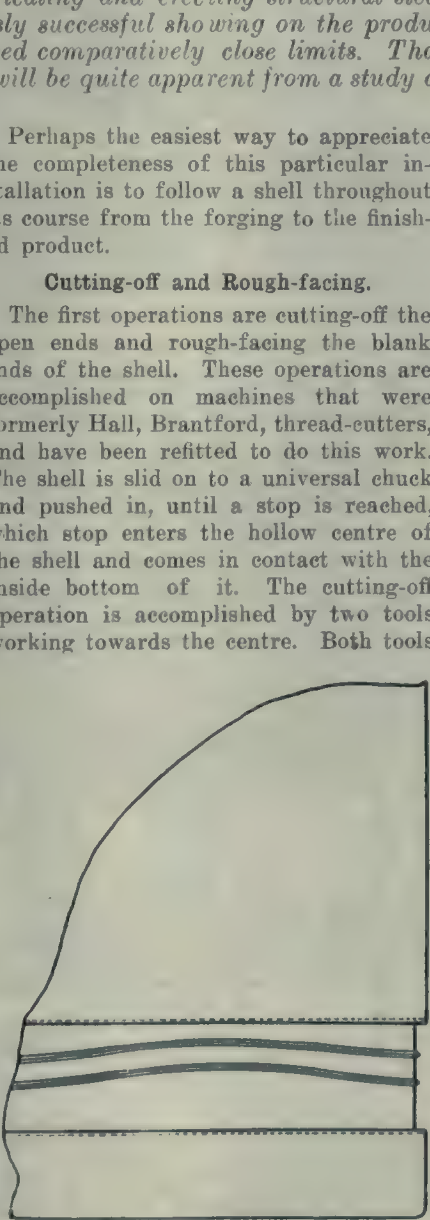


FIG. 1. PART DEVELOPMENT OF SHELL SHOWING WAVED RIBS (THREE WAVES).

are power-driven from the same feed screw, which has a right and left-hand thread on either end, and is connected by a worm and worm gear to a shaft which is belt-driven from an extension of the cone pulley shaft. In this operation, a cutting lubricant of soda water is used. About thirty shells are machined without regrinding the tools. Two machines are fitted up for the cutting-off of the blank ends of the shell.

The next operation of roughly cutting off the open ends to length is also being done on three adapted Hall machines which operate somewhat similarly to the others, but have a slightly different tooling arrangement. The cut is, of course, not so deep as in the case of the blank end and can therefore be accomplished much more quickly.

In the regular machine shop of the plant, a number of standard lathes have been fitted up to do the above work, and universal chucks are generally utilized with a stop of some simple construction. Parting tools are fed in by the cross-feed of the machines. A 48-in. Bullard boring mill is used for facing the blank ends, a circular jig being bolted to the table of the machine, and 24 shells being handled at one time. A tool in each of the two toolholders is used, and the average rate of machining is about 50 shells per hour.

The best runs on the two operations are as follows:—Cutting-off the back end, 240 shells in 11½ hours; Cutting-off of the open end, 535 shells in 11½ hours, each operation being accomplished by one man on one machine.

First Setting on Flat Turrets.

After the cutting-off operation, the shell goes to one of the many Jones & Lamson and Pratt & Whitney flat turret lathes, to be put through the first series of operations. There are four distinct operations in the first series, as shown in Fig. 13. In the first operation, the shell is slid on to the centering chuck shown in Fig. 17, and up against the stop as shown in Fig. 13. This centering chuck was designed by the engineer in

charge of the department. The body of the shell is rough-turned up to about 2 inches of the open end, and a second tool turns the shell to finished diameter for the same distance. The blank end of the shell is next re-faced and the recess formed, after which the corner of the shell is rounded.

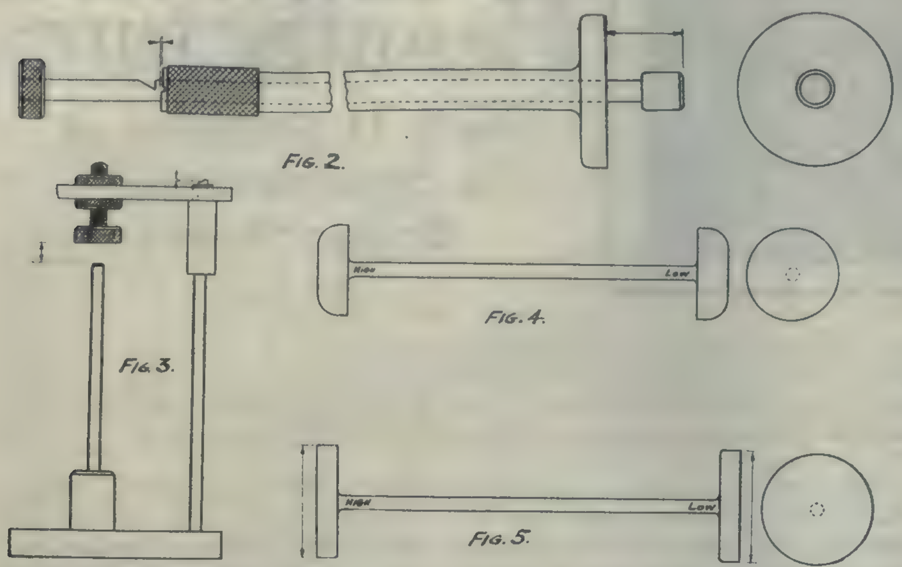


Fig. 2. Fig. 3. Fig. 4. Fig. 5.

FIGS. 2 TO 5. GAUGING APPARATUS EMPLOYED IN THE MACHINING PROCESSES.

As will be seen in Fig. 1, there are wave lines in the bottom of the recess groove, sufficient material is therefore left in the bottom of the recess for these lines to be later formed. The recess, however, is made full depth at the extreme outside edges. The next operation is the under-cutting of the edges of the recess. This under-cutting is made so that when the copper band is pressed into the groove it will fill up the under-cuts and be securely held in place. For a similar reason, the wave lines are turned in the bottom of the groove. The general form of these wave lines, which are formed in the next operation, can be seen from Fig. 1. On the face of the chuck a carefully designed triple wave cam has been placed, Fig. 13. By referring to Fig. 18, the tool can be seen, and it will be noted that this tool is guided by the form of the wave cam. Thus, what promised to be a difficult piece of work—has turned out to be extremely simple. This completes the first series of operations on the flat turrets. The production per hour of one machine is about seven shells, and the best run on one machine has been 110 shells in 10½ hours.

Second Setting on Flat Turrets.

In this setting, the shell is reversed in the chuck and placed against a stop as shown in Fig. 14. The principal operation is that of boring in this second setting. There are four independent boring tools placed on the turret, and Fig. 14 also shows the ingenious method of holding these boring tools rigidly in position. A solid bar extends right across the turret and is supported by the two holders. The other two boring bars are mortised into the solid bar. This gives excellent support.

When the shell is chucked, the nose end is rough-turned and the end re-faced. The next operation is to rough-bore the powder pocket. The disc seat is then rough-bored, both afterwards being finish-bored. Stops on the machine indicate to the operator when the depth of bore is accomplished. The tool does not bore its way into the whole depth of the shell, the forgings being so made that there is only a small amount of metal to be removed at the shell bottom.

The shell is now removed and the operator blows out all the chips and any cutting lubricant that remains, by means of a jet of compressed air. A gauge shown in Fig. 4 is then inserted to see if the powder pocket is between the limits allowed, and this formed gauge has a small and large end, each of which represents the corresponding limits to which the shell may be bored. The disc seat is similarly treated with the gauge shown in Fig. 5, which was made for this special purpose. The depth of the bore between the disc seat and the bottom of the powder pocket is tested with the tool shown in Fig. 2. The thickness of the bottom of the shell is also tested, and this tool is shown in Fig. 3. For this operation, 16 flat turret lathes are employed, and the production per hour of one machine is fourteen shells. One man has machined 140 shells in 10½ hours on one machine.

Heat Treatment and Swedging.

After these operations, the shells are taken to the heat treating department, where they are first placed in a gas furnace. There are four gas furnaces and all were constructed in the plant. The shells are heated to a temperature of 1460° F. and are cooled in tanks of whale oil or Houghton Soluble Oil. There are two tanks and these are placed in containing vessels of water. Connected to the oil tanks are a series of coils placed in the containing vessels. Oil is circulated through the coils and is thus cooled by the water, the circulation being maintained by two centrifugal pumps, each tank having its individual circulating pump. One pump is belt-connected to a 3-h.p., d.c., Can. Gen. Electric Co. motor, and the other is direct-connected to a 2-h.p., d.c., Can. Gen. Electric Co. motor. To facilitate the cooling of the oil, it has been found necessary to agitate it by jets of compressed air, this being supplied from the high pressure lines of the company. A high pressure blower, belt-connected to an 8-h.p., d.c., Crocker-Wheeler electric motor supplies air for the gas furnaces.

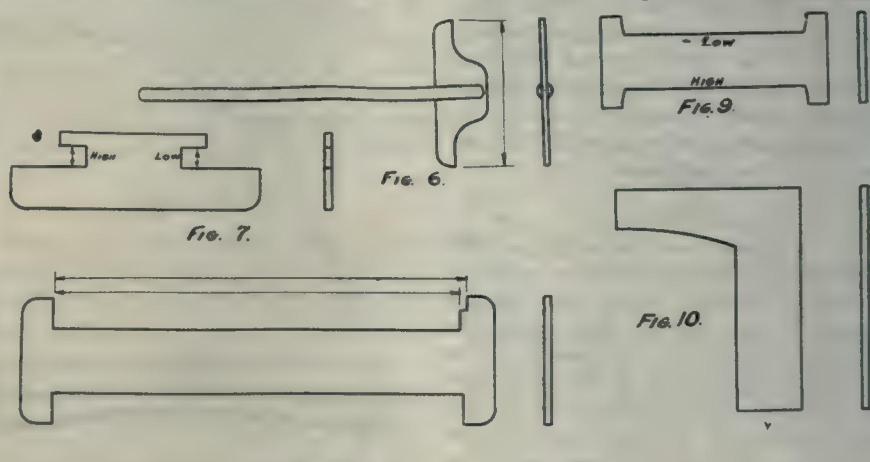
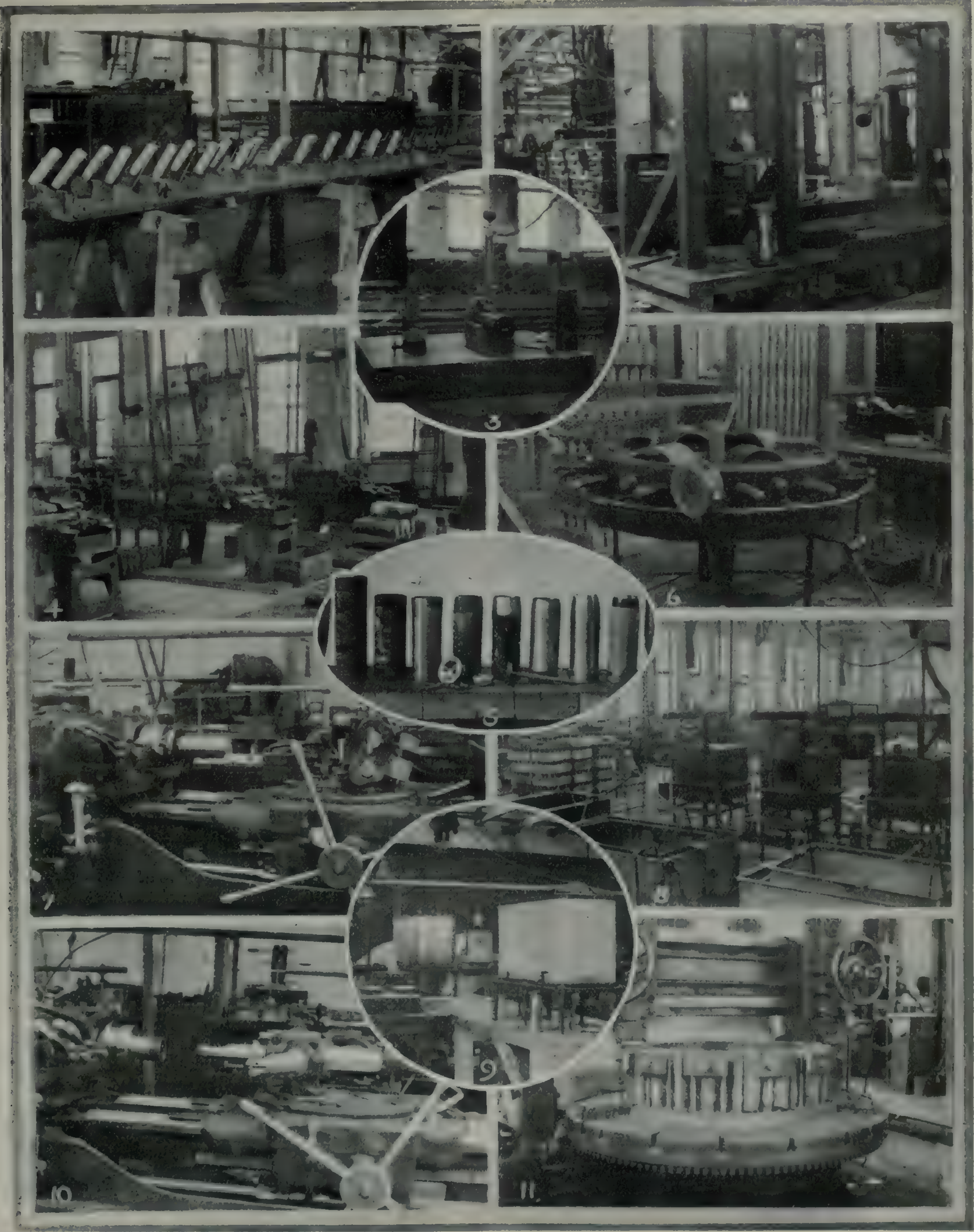


Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10.

Fig. 11.

FIGS. 6 TO 11. GAUGES EMPLOYED IN THE MACHINING PROCESSES.

The shells are placed in the oil tanks in a box-like galvanized iron retainer, in which a large number of holes have been punched. Over each of the two oil tanks



(1) Painting tables. (2) Box containing shot, showing ingenious arrangement for measuring out correct number for each shell automatically. (3) Testing for hardness with Shore scleroscope. (4)—J. H. Hall cutting-off machines. (5) Shells in process. (6)—Banding press. (7) J. & L. flat turret tooled up for first series of operations; shell body has been rough turned and the base finish turned ready for the recess and wave lines; note cam on face of machine and waving tool in position. (8) Oil tanks and gas furnaces. (9) Assembling department, showing resin tanks and weigh scales. (10) J. & L. flat turret tooled up for second series of operations (boring). (11) Bullard boring mill facing base of shells.

a 2-ton hoist is placed. These hoists are used to raise a batch of shells in their retainer out of the oil, which drains off through the already-mentioned holes. The shells are next placed in boxes of sawdust, to absorb all surplus oil adhering to them, and after being tumbled around by hand in the sawdust, two spots on opposite sides are cleaned up with a buffing wheel, on which the test for shell hardness is made by means of a Shore scleroscope. The degree of hardness is marked on each shell and they are placed in shelves according to same. This department is able to handle about ninety-six shells per hour.

The shells next go to the annealing furnaces, of which there are two. These furnaces were also made in the works. The length of time spent in the annealing furnaces and the temperature at which the furnaces are kept, are points determined by the degree of hardness of the shells. An experienced operator is in charge of this department and excellent results are being attained.

The noses of the shells are next heated to about 1,400 degrees F. in a lead pot, and the proper depth of immersion in the lead is obtained by simply slipping the shells over pipes which extend out of the molten lead the proper distance. The lead pots and oil furnace for melting the lead are also products of the works. The fuel used is ordinary crude oil mixed with a jet of compressed air. A little charcoal is placed on the surface of the lead to prevent excessive radiation of heat and oxidation of the metal. It has also been found, with the surface of the lead covered with charcoal and charcoal ash, that the lead does not adhere to the steel.

As soon as the nose of the shell has been heated to the correct temperature, it is bottled in, or swedged. The swedge used was originally a 50-ton Murphy toggle riveter, and is operated by compressed air. A second machine, which was originally a Bertram punch, has been fitted up for the same purpose. Both sizes of shells, namely, the 15 and 18-pounders, can be swedged in either or both machines by simply changing the tools. The toggle riveter is operated by

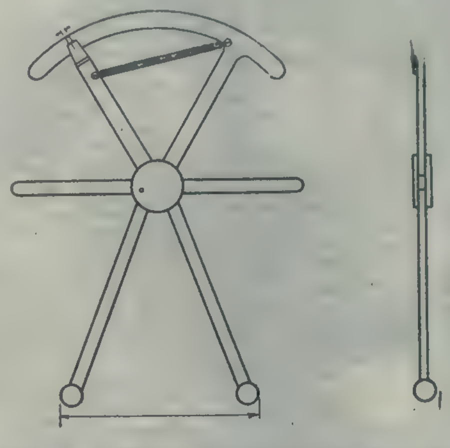


FIG. 12. GAUGING APPARATUS EMPLOYED IN THE MACHINING PROCESSES.

compressed air, while the punch is belt-connected to a 5-h.p., d.c., Can. Gen. Electric Co. motor. In the case of the 18-pounder shell, it is necessary to drop in the steel disc before swedging.

Immediately after swedging, the shell is placed in the lead pot again to be reheated. This second heating is accomplished with the shell immersed in the lead somewhat further than in the case of first heating. As soon as the shell becomes a dull red, it is lifted out by tongs and placed nose downward in a box of powdered mica which allows it to cool slowly, and, at the same time, be out of contact with the air. This process of annealing, as it were, is done to overcome the effects of the chill caused during swedging. It is found that the nose is left sufficiently soft by this process to allow of the finish machining operation to be accomplished without undue difficulty. About 100 shells per hour can be swedged with this equipment.

Third Setting on Flat Turrets.

The shell now passes to the third series of operations on the turret lathes. It is chucked with the nose end outward in this operation, as in the second series of operations. A stop in the spindle ensures the shells always being in identically the same place in the machine. The first operation is to bore the inside of the nose and face the end. The outside of the nose is also rough-turned and formed. The forming is accomplished by means of a modification of the tapering arrangement for the flat turret, using one edge of a piece of hardened steel for a template. The tool carriage is kept closely in contact with the forming edge of the template by means of a stiff spring. By a similar operation, the inside of the nose is bored to the profile of a second template. This forming of the inside extends only for a short distance inside the nose of the shell.

After these operations are accomplished, the turret is swung around and the straight bore of the nose is reamed. Another swing of the turret and the end of the nose is tapped. A collapsible tap is used, and the tool is quickly withdrawn when it has accomplished its work. The shell is then inspected by employees of the works, using the tools illustrated in Figs. 6, 7, 8, 9, 10, 11 and 12. The tooling of a turret lathe for this operation is shown in Fig. 19.

After the shell passes this inspection, it goes to the finish grinders, or the finish turn operation. About 14 shells per hour can be machined on a turret lathe equipped with tools for the third operation, although recently one man machined 151 shells in 9½ hours.

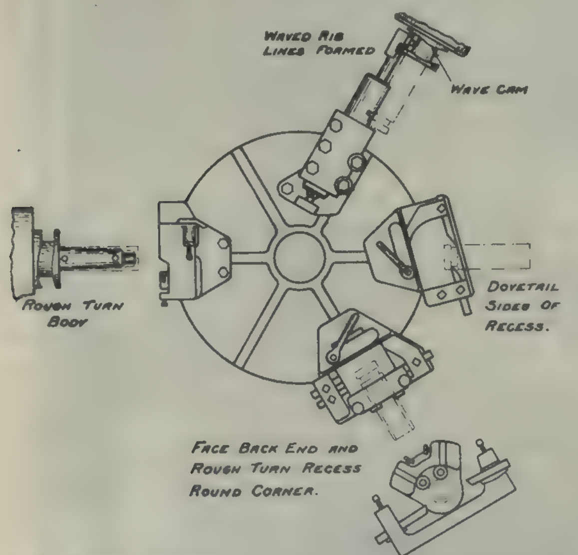


FIG. 13. FIRST SERIES OF TURRET LATHE OPERATIONS.

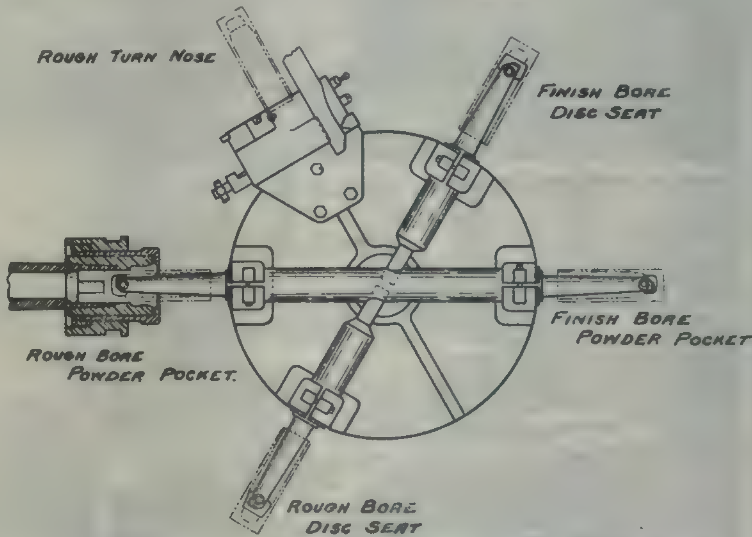


FIG. 14. SECOND SERIES OF TURRET LATHE OPERATIONS.

Grinding Operation.

Before being ground, the shell has to be provided with one centre to be held in the grinding machine. Tools shown in Fig. 15 are placed on the small ends of the shell. These tools each contain little hardened steel centres and are screwed into the small or open end of

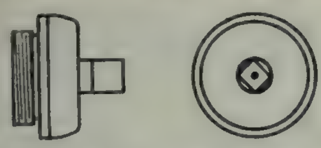


FIG. 15. SHELL GRINDING CENTER.

the shell. The shell is clamped in a hinged cylindrical vise while this operation is performed.

In the grinder, the large or back end of the shell is clamped in a 6-inch Skinner scroll chuck, which is fastened to the spindle. These chucks have three jaws. The inserted plug centre is supported by the tailstock spindle. The machines used are four Landis plain grinders: two 10 in. x 24 in., a 10 in. x 36 in., and a 10 in. x 52 inch. The wheels used are of 2-inch face and are traversed the whole length of the shell, from the nose to the recess. The noses of the shells

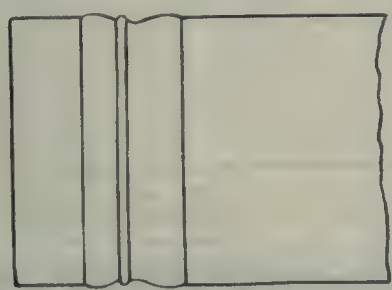


FIG. 16. SHOWING COPPER BAND AFTER TURNING.

are not ground, but are turned. It has been found that it taxes the capacity of these four grinders to keep pace with the production of the other departments. For this reason, the grinding of the nose had to be abandoned, although the operation was being carried on most successfully. The wheels are dressed frequently to assure the finished shell being accurately ground. Limit gauges are provided each operator, and he calipers his work in the machine. The limits allowed on the outside diameter vary by ten one-thousandths of an inch.

Finish Turning Noses on Engine Lathes.

There are eight lathes of various makes equipped for finish-turning the nose of the shells. The operation is practically simple, except for the fact that the cross-feed has been disconnected. The adjustment of the tool is made by the compound rest. The toolholder is pressed closely against a profile steel template by means of weights suspended in the air, and, as the carriage moves along the bed of the machine, a hardened steel point guides it, as shown in the diagram, Fig. 20. The template is formed of hardened steel and is the exact shape of the profile of the shell. The apron of the carriage is connected to the feed screw as usual.

The annealing process, after swedging, leaves the shells in excellent condition for turning, and it is found that they can be easily turned at the rate of from 40-50 feet per minute with a moderate feed. One operator can finish about 12 shells per hour with a lathe equipped as indicated above. One man, however, has finished 151 shells in 9½ hours.

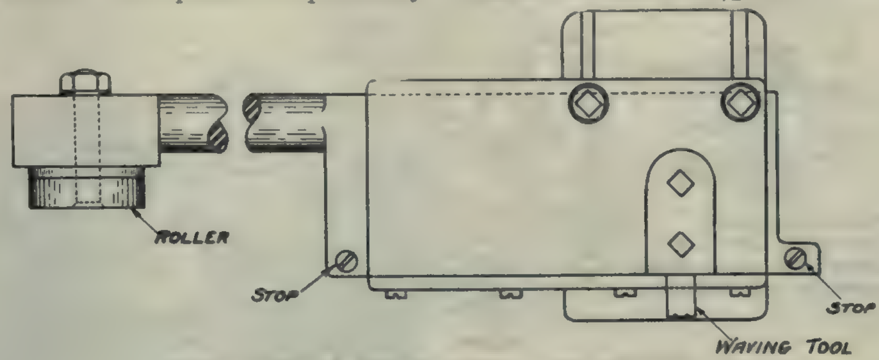
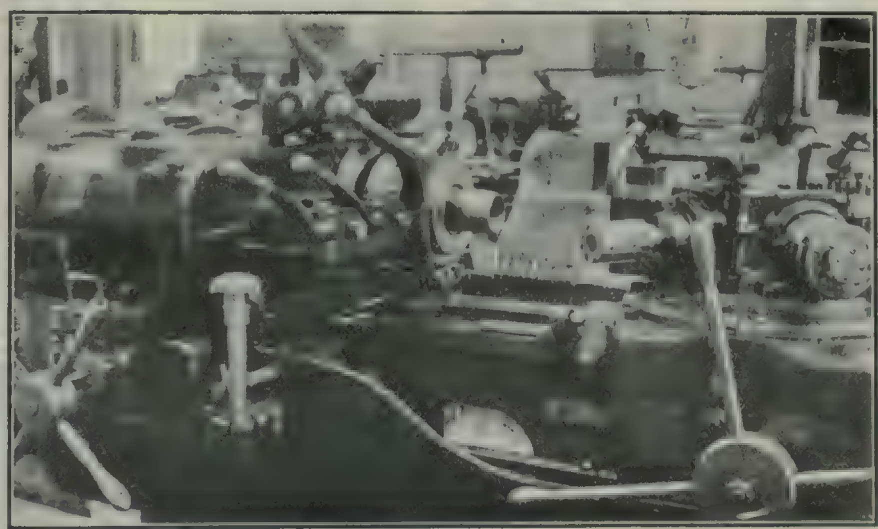


FIG. 18. WAVE FORMING TOOL AND HOLDER.



JONES & LAMSON FLAT TURRET TOOLED UP FOR THIRD SERIES OF OPERATIONS.

Sand Blast and Minor Operations.

After being finish ground and turned, the shells proceed to the sand blast room where the recess containing the wave lines, and also the blank ends are cleaned up, being usually in a blackened condition, resulting from the heat treatment. Next the shells are brought out and washed in a solution of hot soda water. Then three nicks with a cold chisel are made in the waves. These nicks are to give additional resistance to the bands turning after they are once pressed into the grooves and also release the air that would otherwise be trapped between the wave lines.

From the sand blast room, the shells go to a corps of Dominion Government

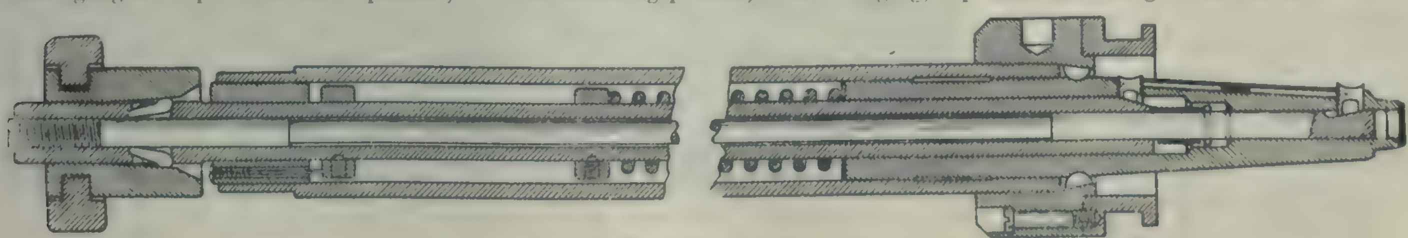


FIG. 17. SECTIONAL VIEW OF EXPANDING CHUCK SHOWING DETAIL.

Inspectors for a first inspection. After coming from the inspector, the shells are marked in a Dwight slate marking machine and the copper bands slipped on loosely and pressed home by two machines especially constructed for this purpose by Lymburner, Ltd., Montreal. As there are two sizes of shells made in the plant, there are two presses, one for each size of shell.

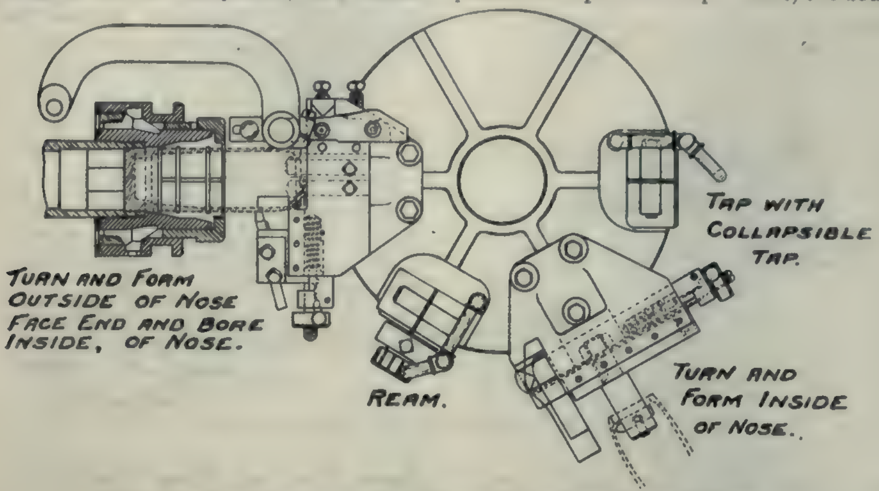


FIG. 19. THIRD SERIES OF TURRET LATHE OPERATIONS.

Next, the copper rings are turned to a shape or profile somewhat similar to that indicated in Fig. 16. Fig. 21 is a representation of the tool by which the profile is tested. To turn the bands, the shell is fitted with a plug in the open end similar to that used in the grinding operations. The back end is gripped in a three-jaw Skinner chuck. One man has been able to turn 240 copper bands in 11½ hours.

Assembling.

The shell now goes to the assembling tables. First the tin powder cup is placed in the powder pocket and the disc placed on top of the cup. Next, the brass tube for the powder is screwed into the steel disc, then a little funnel is placed over the open end of the shell. This has a central guide collar which fits over the end of the brass tube and holds it exactly in the centre. The bullets are now put in the funnel, and the exact number is automatically measured out each time by a very ingenious little apparatus. The approximate number in each shell is 375, and it has been found that there are about 41 to the pound, each bullet being in the neighborhood of ½ in. in diameter.

The shell is placed on an air agitator to settle the bullets into place, and molten resin at from 3750 to 4000 F. is poured into the casing. The shell is immediately thereafter placed on a delicate balance and one or two pieces of small shot added until the exact weight is obtained. While the resin is still soft, the brass socket is started in by hand and screwed down a few turns, the brass thread being coated with red lead before being started in the shell.

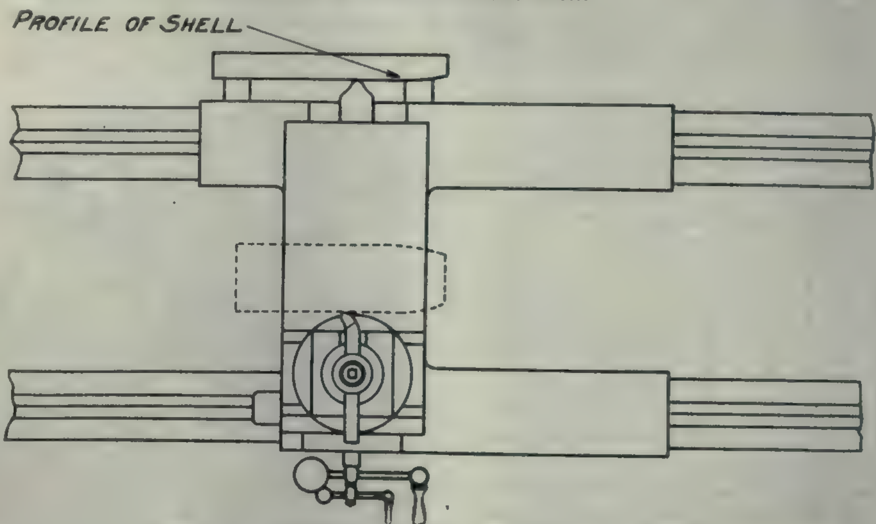
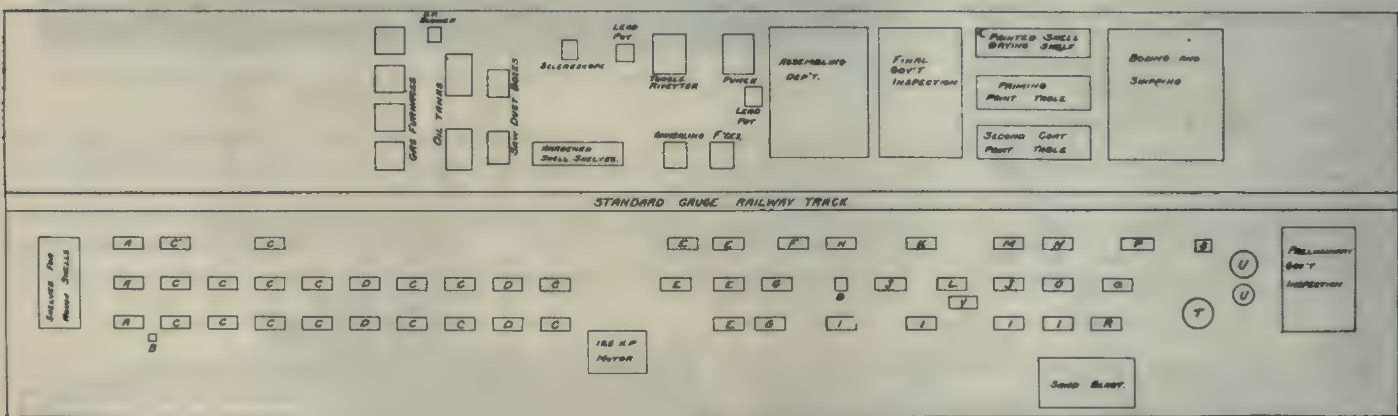


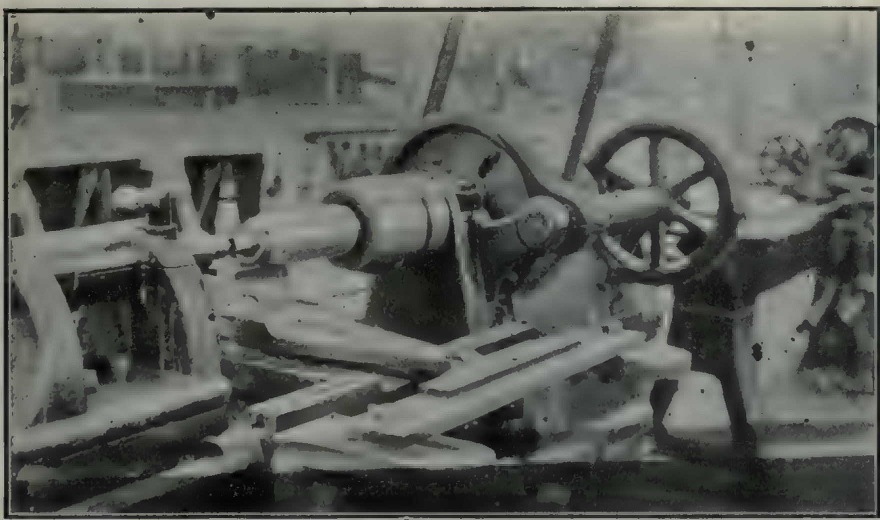
FIG. 20. FINISH TURNING ON ENGINE LATHE.



APPROXIMATE ARRANGEMENT OF MACHINE TOOLS AND EQUIPMENT IN SHELL DEPARTMENT, AS AT MARCH 25, 1915, AND KEY TO SAME:

A—John H. Hall & Sons, Brantford, thread cutters turned into cutting-off machines. B Emery wheels. C—Hartness flat turret lathe manufactured by Jones & Lamson Machine Co., Springfield, Vermont, working on first series of operations. C Pratt & Whitney flat turret lathe. D—Jones & Lamson flat turret lathes working on second series of operations. E—Jones & Lamson flat turret lathes working on third series of operations. F—Canada Machinery Corporation engine lathe used for cleaning scale from shells and polishing back end. G—Jones & Lamson flat turrets turning copper bands. H—Canada Machinery Corporation engine lathe finishing brass sockets. I—Landis grinders finish grinding bodies of shells J—Lodge & Shipley lathe turning copper bands. K—Pratt & Whitney flat turret working on third series of operations. L—Canada Machinery Corporation engine lathe (London heavy duty) used for cleaning and polishing shells. M—Von Wyck Machine Tool Co. (Cincinnati, Ohio), engine lathe used for finishing brass sockets. N—American Tool Works, Cincinnati, Ohio, engine lathe used for turning shell noses to finished diameter. O—Canada Machinery Corporation engine lathe turning copper bands. P Lodge & Shipley "Twink" lathe, finish turning noses of shells. Q—Engine lathe rebuilt by H. W. Petrie & Co., turning copper bands. R—Garvin Machine Co., New York City, engine lathe used for cleaning up shells. S—Dwight slate-marking machine. T—Hot soda water tub. V—15-lb. and 18-lb. Lymburner, Ltd., Montreal, banding press. "V"—Table for putting in plug centres.

The shell is next placed in a vise and clamped tightly. An iron plug is screwed in the brass socket and a Stillson wrench is used to screw the brass socket home. A piece of pipe is usually put on the end of the Stillson, and the operator walks around the vise and has at his disposal about 36" of leverage. This will give one an idea of how tightly the sockets are screwed home. The idea of inserting the iron plug in the top of the brass socket is to prevent the brass from becoming distorted by the excessive strain put upon it with such a leverage. The brass sockets are received partially machined from the Canadian General Electric Co. and the James Robertson Co., and these are shown in Fig. 11 as they come from these firms.



FINISH TURNING ON ENGINE LATHE.

As the brass socket is screwed home, the little brass powder tube enters and passes through the socket central hole, projecting through slightly when the socket is in place. A little aluminum plug is placed in the end of the tube and a bit of wire solder bent in a circle is placed over the projecting end of the brass tube. A special type of soldering iron is used to solder the brass tube to the brass socket. This operation is rapidly done because the solder is cut and bent in circles in large quantities before being sent to the assembling tables.

After the soldering operation, the aluminum plug is withdrawn and a bit of cotton waste inserted in the brass tube to keep dirt and chips out of the tube and powder tin. Four men in this department have dealt with 653 shells in $10\frac{1}{2}$ hours.

GENERAL VIEW OF SHELL SHOP.

Finishing Brass Sockets.

This operation is carried out on engine lathes. The bottom of the socket is faced and the brass tube cut off flush. Next, the outside is turned and formed. Gauges are furnished to test the correctness of the profile and the depth of the recess in the socket. These gauges are shown in Figs. 22 and 23 respectively. The best production to date has been 211 in $11\frac{1}{2}$ hours for one man.

Final Operations.

The shell is brought back to the assembling benches again and a tap is run into the brass thread to clean it out. Next the waste in the brass powder tube is removed and a rod is inserted to see if the tube is absolutely clear for its full length. The shells pass through here to the final Government inspection, proceeding thereafter to the painting tables.

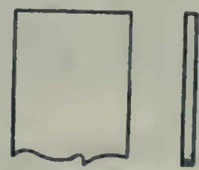


FIG. 21. COPPER BAND PROFILE GAUGE.

These tables are arranged as shown in Group Fig. 1, the little iron rods projecting through enter the powder tube, and as the operator paints the shell he spins it around these rods. It has been found that the painters can do excellent work with this simple apparatus to assist them. The priming coat consists of black japan, and then the shell is placed in a heated cupboard to dry. A final coat of grey is applied and the nose is painted with a red lead. A brass plug is screwed fairly snugly into the brass socket to keep dirt out of the powder tube and to protect the brass from injury.

FIG. 22. SOCKET PROFILE GAUGE.

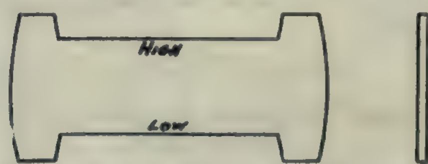


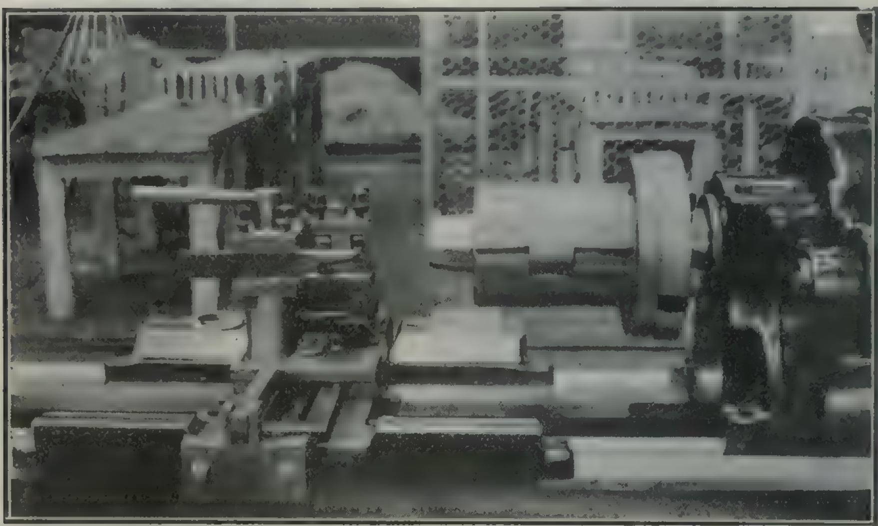
FIG. 23. SOCKET RECESS DEPTH GAUGE.

After this, the painted shell is placed on a shelf in the same cupboard to dry, and is later packed in batches of six in specially constructed wooden boxes, which are reinforced with flat iron strips. Each box is fitted with two hemp handles. The boxes are loaded into railway cars, backed on to the adjacent siding, and shipped.

General.

The shell department has been placed in one of the large shops previously used for fabricating structural steel work. There are no definite boundaries to it, but its general dimensions are about 240

feet x 70 feet. The shells are transported from machine to machine on small trucks. Two shifts of men per 24 hour-day are worked. The day shift works ten and one-half hours while the night shift work eleven and one-half hours. Six days per week are worked. All operators of machines are on straight piece work, with the exception of the heat treatment department. The whole shop is extremely well balanced and the machines are working at an extremely high efficiency pitch, and perhaps in no other shop in Canada to-day are shells being manufactured under more ideal circumstances than in that here described. The artificial lighting is excellent, as is also the natural lighting. Ventilation has also been carefully studied. The present output is 1,500 shells per day.



FINISHING BRASS SOCKETS ON ENGINE LATHE WITH SPECIAL CHUCK AND TOOL POST.

STEEL BLANKS OR FORGINGS DISTORTION.

ARTICLES made from steel blanks or forgings, states Alfred Herbert's Monthly Review, are frequently out of truth after the machining is finished, in spite of the fact that the machining may have been done with the greatest accuracy. Gear blanks may be distorted, crank shafts bent, holes or pins machined parallel may be no longer parallel when removed from the machine, and other inaccuracies may arise. Such troubles can only be overcome with certainty by one method—heat treatment after roughing out and before finishing. The removal of material invariably releases forces which, so to speak, have bound each other. The effect of this is often slow, and change of form does not occur until some time after the metal has been removed.

Heat treatment, if properly, conducted, restores the internal equilibrium of the molecules, and the small amount of material left for finishing does not seriously affect the balance of the minute internal stresses left after heat treatment. The nature of the treatment required depends upon the material used and on the final condition required, and it ranges from simple annealing to delicate tempering processes. Care must be taken to ensure that the heat treatment does not introduce fresh internal stresses.

ALTERNATING CURRENT FOR ARC WELDING.

IN the "question and answers" section of the General Electric Review the following question appears: "Attempts have been made by a steel foundry to fill holes in steel castings by using alternating current for arc welding, but the welds produced have been unsatisfactory. The energy was supplied from a 50 cycle, 440-60-volt, 25-kilowatt single-phase transformer, and the welding current has raised from 100 to 400 amperes. Is failure due to the fact that alternating current was used? If not, wherein is the apparatus unsatisfactory?"

In reply one of the company's engineers says: "We would attribute the lack of success to the use of alternating current. Attempts have been made to utilize alternating current for arc welding, but, as far as we know, all of them were practically failures. . . . The best equipment would be a flat-compound wound direct-current generator driven by a constant speed induction motor, the motor to have an automatic control device for regulating the amount of current drawn from the line and for preventing injury to the generator when starting the arc."

MANUFACTURE OF CHARCOAL.

THE British Board of Agriculture has issued an interesting leaflet dealing with the manufacture of charcoal. It states: "In consequence of the war the demand for charcoal, both for heating purposes and for ammunition, has already greatly increased, and it is probable that it will remain high as long as hostilities continue. There is no difficulty in manufacturing charcoal in kilns; the initial expenditure is small, and the amount of skilled labor required is not very great, while wood which might not otherwise be utilized is turned to account. It would be unwise, however, to attempt to make charcoal without some skilled labor, and, although it has been found possible in an emergency to employ twenty to thirty unskilled men under a skilled charcoal-burner and a good foreman, there are some operations which only a trained and experienced man can efficiently perform."

Details are given of the site for the kiln, the covering and firing of the kiln, regulation of the burning, opening the kiln, and the yield of charcoal.

BRASS TRADE OPPORTUNITITS.

ITALY, in 1912, took £408,500 worth of brass and brassware from Germany. Norway and Sweden together took £274,600 worth, and the United States of America took £146,200 worth. Then there are the valuable South American markets, such as Argentina, to which Germany sent brass goods to the value of £165,000; Brazil, which accounted for £112,700 worth; Chili, which took £49,500 worth, and Uruguay, which was a customer to the extent of £24,000. Austria's exports, too, although much smaller than those of Germany, are worthy of notice, amounting as they did last year to £1,057,750. Her principal markets were: The United Kingdom, £88,700; British India, £36,600; Russia, £98,700; Italy, £90,400; Roumania, £79,000; Turkey, £37,700; France, £26,300; and Argentina and Brazil, £16,800. In all these markets our manufacturers have such opportunities as they never had before for capturing Austria's brass trade.

Soldering. — It often happens when soldering with killed spirits as a fluid, that the latter cannot be applied thick enough to insure a good joint. Add some starch to the killed spirit, and boil the mixture, so as to make a sort of syrup, and you will find that you can make a far stronger job than otherwise, especially when soldering up tins which have to withstand pressure from within, such as preserve tins. The starch is, of course, turned to charcoal; but this does not hinder in the least, and can be wiped off.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SIX-SPINDLE AUTOMATIC SCREW MACHINE.

A SIX-SPINDLE automatic screw machine represents the latest product of the New Britain Machine Co., New Britain, Conn. The new model is designed for heavy service, accurate work and simplicity of set-up and operation. Size for size, it is claimed to be the heaviest multiple spindle machine on the market and incorporates many refinements and improved features. In consequence of its rigidity of construction, heavy cuts and coarse feeds are practicable, thereby increasing productivity. The base, forming the chip pan and oil reservoir, extends to the floor, thus dispensing with legs, while the broad foundation thus obtained, together with the greater weight of the machine, tends to prevent vibration and insure a high degree of accuracy.

Six spindles make it possible to perform a greater number of distinct operations, and on work requiring less than the maximum number of operations of which the machine is capable, the production may be considerably increased by sub-dividing the longer operations—drilling, box-tooling, etc. This, of course, reduces the time on the finished piece to a fraction of that otherwise required.

The spindles are of liberal diameter, hammer-forged from chrome-nickel steel, heat treated, hardened and ground. The spindle bearings are of liberal proportions, made of fine quality bronze bearing metal, ground straight inside and taper outside. In order to maintain accuracy of the machine, provision is made for taking up wear in the bearings without disturbing their alignment.

Ball thrust collars, provided to receive the end thrust due to tool pressure, contribute to a reduction of power required to drive the spindles. Change gears provide six rates of spindle speeds, and a separate system of change gears is provided for effecting changes in feed by varying the speed of cam shaft. The spindle cylinder, which is heavy in design, is always indexed at constant speed.

The threading spindle is driven independent of the others, and, by means of change gears, its speed can be varied to suit the requirements. The threading mechanism operates independently of tool slide, while the die is run on and off with the box tools in operation. Left-hand threads are cut by inserting an extra gear in the train which drives the threading spindle, and this reverses the motion of the spindle in threading, while cutting tools remain the same.

Indexing mechanism, patterned after the "Geneva motion," gradually accelerates the heavy cylinder at the time of indexing, and as gradually checks its motion without shock. Final accuracy in indexing is by means of an extra wide rectangular latch entering notches in the circumference of the spindle cylinder.

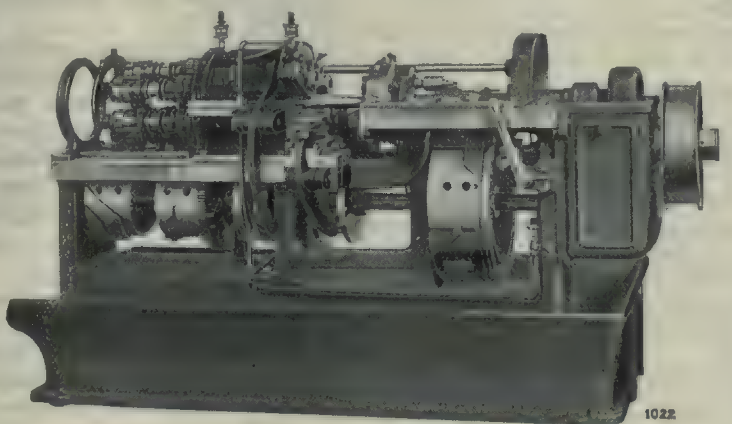
The tool slide is of extremely rigid construction and so designed that thrust of work is evenly balanced. The ways are large and of such length that there is no overhang. The tool slide cam is laminated similar to a leaf spring, and this patented construction permits of adjustment of one cam to all length of work within the capacity of the machine. The direction of spindle rotation being right-hand, permits the use of standard tools.

The cam shaft is driven through a large internal gear on the inner circumference of the feed cam drum, a method which tends to reduce the power necessary. Gears are machine-cut throughout, a feature of importance being the complete elimination of all chains, worm and bevel gears.

Hand control levers on each side within easy reach of the operator, enable power feed to be instantly stopped or started, these, in connection with a hand feed crank for testing all feed movements and tool positions, being essential features, as in setting up, testing and adjusting tools they save breakage.

The oil distributing system is designed to avoid as much exterior piping as possible, and this is accomplished by conveying the oil through the underside of the tool-slide into a chamber at the centre surrounding the driving shaft bushing, from which it is tapped off at the circumference through short tubes to the individual tools. The oil pump is driven at a constant speed.

That portion of the bed directly beneath the work has a 45 degree slant towards the back side of the machine, so that chips and work as cut off are carried to the side. The chip pan is widest on this side and slopes toward the rear end, where there is an oil well with strainer, from which oil is distributed to the work. This construction permits the oil to drain off before chips are removed and makes it possible to rake out the chip pan end-wise without stopping machine or removing splash apron.



SIX-SPINDLE AUTOMATIC SCREW MACHINE.

The machines are designed to accommodate either belt or motor drive.

SAFE HAND TOOLS IN THE SHOP.

PERSONAL caution is the greatest safeguard, says Bulletin No. 19, issued by the National Founders' Association Committee on Safety, whether observed in the general and apparently important affairs of industrial life or applied to specific and seemingly trivial details. A spill from a twenty-ton ladle of molten metal may cause a serious burn, yet a chip struck from the battered head of a twenty-cent chisel may result in blindness to an employee. A defective weld in a crane chain may allow a load to "let go" with disastrous consequences, but the use of a weak, cross-grained or splintered sledge handle may let the sledge fly across the shop and injure workmen who may be in its path. Con-

siderable injury may also be traced to the use of loose-fitting wrenches, splintered or broken shovel handles and to other uncared-for hand tools.

Tools Contributing to Injuries.

The largest contributors to injuries in the latter class are chisels, punches, wedges, blacksmith's tools, stonecutters' tools and similar small hand tools which are subjected to frequent hammer-blows, in consequence of which their heads become readily "mushroomed." A mushroomed head presents a dangerous condition, for the next hammer-blow may break off one of the slivers of steel hanging to the body of the tool and send it flying through the air, with great risk of injury to the man handling the tool or to others nearby. The remedy costs little, is well known, simple and effective. When the head of such a tool is found to be chipped, cracked or mushroomed, it should be promptly laid aside and not used again until the head has been ground down or dressed to its proper shape.

A good practice applicable to cold-chisels and other tools that must be sharpened frequently is to grind down their heads every time the tools are sharpened, thus preventing the development of a mushroomed condition, at the same time retaining the hammer-hardened ends which will not spread so rapidly in the future life of the tools; this practice also avoids much waste of the steel which would otherwise have to be cut off if the heads of the tools were re-forged.

As a further precautionary measure, all steel hand tools that are liable to be struck by hand hammers or sledges should have the upper part of the shanks shaped round and slightly tapered from the top downward before they are used at all; care should also be taken to make such tools of the right grade of steel, else the battered, over-hanging portions of the tools will readily break off. The heads of chisels used in pneumatic tools are usually hardened and will chip very easily when struck with an ordinary hammer; such chisels should never be used in this way.

Hammer and Sledge Handles.

The character of hammer and sledge handles and their method of fastening is worthy of more than passing notice. If not straight-grained, or if the wood used is "short" in texture, it must be expected that such handles will quickly splinter and break. If attached in a slipshod manner, or if insecurely fitted, or if wedged by nails instead of wedges, or if the handle is water-soaked so as to swell and become only temporarily tight in the hammer head, it is obvious that these ill-fitted handles will become loose, and that the hammers or sledges will fly off when the nails loosen up or when the handle dries and shrinks. When it is recognized that the peculiar function of hammers and sledges is to strike blows with considerable force, it becomes clear that there is no economy in cheap but weak handles, and that all handles should be carefully purchased and properly fastened in place.

COMING CONVENTIONS.

National Association of Manufacturers, Waldorf-Astoria, New York.—May 18-19.

National Machine Tool Builders' Association, Atlantic City, N.J.—May 20-21.

Master Boiler Makers' Association, Chicago, Ill.—May 26-28.

American Iron, Steel and Heavy Hardware Association, St. Francis Hotel, San Francisco, Cal.—May 25-28.

American Supply and Machinery Manufacturers' Association and National Supply and Machinery Dealers' Association, Hotel Bellevue-Stratford, Philadelphia, Pa. (Joint convention.)—June 3-5.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Railway Supply Manufacturers' Association. Convention and exhibit in conjunction with the Railway Master Mechanics and the Master Car Builders.—June 9-16.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

The use of defective file or screw-driver handles also contributes to the sum of injuries caused by hand tools. When such handles are split, the handle end of the file or screw-driver is apt to be forced through the handle and puncture the user's hands, and when these tools are used without handles similar injuries sometimes result. The use of only the best handles is a safe as well as an economical measure.

When smooth-faced hammers or hatchets are used for driving nails, the nails frequently glance and strike persons who are working in the vicinity. This danger can be minimized by the use of hammers or hatchets with their faces roughened.

Wrenches.

Wrenches are wrongly used and abused, sometimes because the management is over-economical, but usually because the employee is too lazy or impatient to secure the right wrenches for the job in hand. Solid wrenches that are too large for the nut or bolt-head are soon worn into a rounded shape that allows them to slip and bruise the workmen's hands, also spoiling the shape of the nut or bolt-head, which in turn presents an added risk of the same kind. Wrenches of the right size but worn beyond the possibility of giving safe and effective service, cause similar injuries. Again the remedy is simple and even economical; the wrenches should be ground or milled to suit larger size nuts, or if there is too little stock left, they should be scrapped. Monkey-wrenches or Stillson wrenches with bent jaws or worn adjusting parts, are also apt to cause injury by slipping; such wrenches should be repaired or replaced. Wrenches are cheap; when in good condition they are not only safest, but do more and better work than the faulty variety.

Electrical Purpose Tools.

The rapidly growing use of electricity for power and light requires that workmen should be instructed to use proper tools when making adjustments on electrically charged apparatus. Screw-drivers, pliers and other tools used for this purpose must be insulated. When the voltage is more than 110, insulated tongs made of hard fibre or other non-conducting material should be provided for safely removing or replacing fuses.

General.

Some effective system should be adopted and carefully followed in each shop to prevent the use of improper or defective handles or tools. Only such handles and tools should be purchased or put into service as are safest and best for the purpose. Even these may in time become unsafe by wear; it therefore becomes imperative that they should be inspected regularly and their safe condition maintained. In shops where such tools are turned into the tool-room or stock-room every night, the storekeepers can be instructed to issue only such tools again as are safely fit for service.

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Vol. XIII. MAY 6, 1915 No. 18

PRINCIPAL CONTENTS.

SHELL PLANTS AND THE WAR DURATION.

THE uncertainty as to the duration of the war seems to have had a great deal to do with the character of the preparations made by nearly all of our plants manufacturing shells. Study of many of the shops engaged in the work reveals the installation of a very large number of the most ingenious and creditable arrangements and devices whose sole purpose is to get around the purchase of new equipment or the disarrangement of the original plant. In a word, the shell business has been extremely prolific in ways and means for getting the most out of standard equipment; in fact, it is certain that no one influence has had or could have a greater effect upon the future design and methods of using standard machine tools in Canada than this unexpected work. Not only have numerous possibilities of the machine tool been brought to light, but the shops generally have been affected somewhat in the same way. Manufacturing concerns have found ways of increasing their capacity, while many jobbing plants, for the time being at least, are turning out duplicate work of a satisfactory quality and at an acceptable price.

The determination of many metal working plants not to make special preparation for the shell work but to do what they can with present layouts does not seem to be altogether justifiable in the light of present experience, for while it may not be considered advisable to invest a large amount of money in special equipment, a re-arrangement of existing machines could be very profitably and economically made. Moving of machines and appliances can be done at inconsiderable expense, particularly when these are motor driven and where suitable cranes are already provided.

In many plants there seems to be a fixed rule that furnaces, oil tanks, etc., cannot be set up in the same room or building as machine tools and assembling operations, therefore much time and labor is expended in the transportation of shells back and forth. With oil or gas furnaces and lead bath, the arrangement of the heat treating department in its proper place in the most direct path of the shells has been proved to be not only feasible, but highly satisfactory.

The plant which prepares for a six months' run on shells cannot be regarded as taking a sporting chance in any sense. Lord Kitchener has been making preparation for a three-year's war from the first, and it is hardly likely that this, greatest of all wars, will be the shortest in duration of any of the more recent international struggles. Plants which assumed this view when inaugurating the business, have already made good and thus will have a tremendous advantage over others throughout the remainder of what has already come to be known as the shell period, and it is more than likely that in the end, the highly specialized plant will more than come to its own.

THE STATUS OF ENGINEERING.

SEVERAL articles have appeared of late in this and other technical journals pertaining to the relative financial worth of the engineering business. The question, like many others, can be answered in both a general and a particular way, either of which, naturally gives rise to much variation of opinion. Generally speaking, "engineering does pay." The field for self-improvement and advancement is greater than that attached to any other profession.

The average junior mechanic has considerable spare time but, on account of long shifts and the necessity of strenuous work at times, is not inclined to devote his spare moments to physics and geometry or to education which he can sell for money later on. His work and surroundings are such that it requires an extra effort on his part to keep his personal appearance such that he can freely associate with his superiors and those who control his personal and material advancement.

The dissatisfied machinist often forgets that, in many cases, he has the making of his own surroundings and that these surroundings again react on himself.

The engineering business does pay in that the fruits of energetic and aggressive self-improvement and personal work are greater, not only in a financial sense, but the results being ever attainable, are a monumental inspiration to further achievement.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 50
Copper, unch-bled, heavy	12 00	12 50
Copper, wire, unch-bled	12 00	12 50
No. 1 machine compos'n	10 00	10 50
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	9 50	10 00
No. 1 brass turnings	7 00	7.50
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	7 00	7 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black Standard	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	47	....	....
½ in.	69	56	....	....
¾ to 1½ in.	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in.	74	61	73	60
4½, 5, 6 in.	....	....	72	59
7, 8, 10 in.	....	....	68	56
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2 in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	41	....	....
½ in.	63	50	....	....
¾ to 1½ in.	68	55	....	....
2 in.	68	55	64	51
2½, 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in.	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 50	20 75
Castings, copper	20 00	20 50
Tin	48 00	48 00
Spelter	16 00	15 00
Lead	5 50	5 75
Antimony	29 00	35 00
Aluminum	23 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex Strong. Size Ins.	D. Ex Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½ $	.32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.75
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.15
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.73
Linseed oil, raw, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. (galvanized)	4 50	4 50
Queen's Head, 28 B.W.G.	4 60	4 60
Fleur-de-Lis, 28 B.W.G.	4 30	4 30
Gorbal's Best, No. 28	4 60	4 60
Viking metal, No. 28	4 20	4 20

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 4, 1915.—Industrial conditions continue to improve gradually, being stimulated by the seasonable weather. Navigation has opened on the St. Lawrence, and considerable activity is noticeable around the harbor and canal. A shortage of tonnage this season will no doubt be felt in shipping circles, although the volume of export trade will probably be above normal on account of the heavy demand by the Allies for foodstuffs and the shipment of large quantities of war material being made in Canada. An interesting trade development is announced in the inauguration of a line of steamers sailing between here and Archangel, Russia. The first boat, the Czaritza, sails from this port on May 22nd. Considerable interest has been aroused in railway circles over the announcement that the Government will operate the Eastern section of the N. T. R.

Steel Market.

The shell industry continues to be the most interesting feature in the steel trade. The demand for shell forgings and rounds is increasing, and the mills are working to capacity to fill all requirements. The Dominion Steel Corporation and Nova Scotia Steel & Coal

Co. are understood to be very busy on war orders outside of the shell business. The demand for structural shapes is light, as the building trade is dull, the permits issued showing a heavy decrease over last year. The demand for tool steel is improving, principally for the higher grades for machining shells.

Pig Iron.

The market is stagnant and demand for pig iron very dull. It is reported that a considerable amount of Canadian pig iron will be shipped from this port during the season to manufacturing interests in England.

Machine Tools.

The outlook in the machine tool trade continues satisfactory, although the difficulty in getting quick delivery of machines is causing considerable anxiety. Further orders for shells have been distributed among machine shops in this province. The Canadian Car & Foundry Co. have sub-let part of their Russian contract to the Montreal Ammunition Co., Lachine; the Lauzon Engineering Co., Levis, and the Lachine Mfg. Co. This business is, of course, additional to the orders placed by the Shell Committee. The supply business is improving, the volume of orders keeping up, but in smaller lots than usual.

Metals.

The outstanding features in the metal markets are the extraordinary advance of antimony and the strength of the copper and spelter markets. The volume of business is improving, but buying is still hand-to-mouth, apart from the demand for metals for ammunition.

The tin market is easier and the situation has improved as regards the New York market. Tin has declined 2c, and is quoted locally at 48c per pound. The copper market is very strong and advancing, being quoted at 21c per pound. Lead is quiet and dull, with prices unchanged at 5½c per pound. The spelter market is unsettled, and prices are nominal. Spelter is scarce and demand greater than supply. Spelter has advanced 3½c, and is quoted at 16c per pound, which is entirely nominal. The antimony market is very strong and advancing. There is a heavy demand for this metal for munitions, and supplies are scarce. The price is nominal at 29c per pound. Aluminum is unchanged at 23c per pound.

Toronto, Ont., May 4, 1915.—The general business situation shows some improvement and the seasonable weather is having a beneficial effect on trade. Crop conditions are very favorable and farming operations well advanced, which has helped to create a more optimistic spirit throughout the country. The recent reverse suffered by the Allies has had a depressing effect in business circles on account of the heavy casualties, but it has also helped to a more complete realization of the severe character of the war and the extent to which this country is involved in the conflict. There are, however, no signs of discouragement, but rather a greater feeling of determination to see the thing through to a successful conclusion.

The shell industry continues to develop and more orders have recently been distributed; every machine shop in the country will soon be engaged in turning out either shrapnel or high explosive shells. The steel trade is showing some improvement, due principally to war orders. The financial situation is easier, but collections are slow.

Steel Trade.

There are signs of increasing activity in the steel trade due largely to the shell industry and other war orders. The demand for shrapnel forgings is greater that Canadian mills can supply and it is understood that orders have been placed in Cleveland, Ohio, for forgings to be machined in Canada. Manufacturing interests are also using more steel but the building trade, on the other hand, is quiet. Prices are firm and unchanged.

The outlook in the steel trade in the States is improving. The railroads are buying more freely, and further large orders for shells for the Allies have been placed recently. Ferro-manganese shipments from England have been received, subject, however, to certain conditions.

"Unless the whole nation works with us and for us in supplying the necessary arms, ammunition and equipment, successful operations in the various parts of the world in which we are engaged will be very seriously hampered and delayed." —Lord Kitchener.

Pig Iron.

The market continues dull with light demand. It is reported that a considerable quantity of Canadian pig iron will be shipped to the Old Country this season.

Machine Tools.

The situation is practically the same as last week, deliveries being slow and consequently business is being held up. Several orders for shells have recently been placed with Western concerns and also more Eastern firms are now preparing to handle the business. Inquiries for machine tools are being received by dealers, who are filling orders as fast as circircumstances will permit. There is a big demand for shell machinery in the States as well as in Canada and machine tool makers are working to capacity to meet the situation. Tools for ordinary purposes are moving slowly and the demand for woodworking machinery is light.

Metal Market.

Business continues to gradually improve, largely on account of the demand for metals for ammunition. Ordinary business, on the other hand, is slow although the outlook is better. The feature of the market this week has been the strength of copper, which continues to advance. The tin market is easier and declining, but spelter is strong and advancing. Antimony is higher with the market very strong.

Tin.—The market is dull and easier with spot price irregular. The situation has improved as regards the New York market, the British Government having modified the restrictions placed on the export of tin to the States. Visible supplies are increasing and the market is lower. Tin is quoted at 48c per pound, being a decline of 2c.

Copper.—The market is strong on heavy demand for ammunition. The present high price of copper has resulted in the resumption of all the high cost producers and there is every probability that there will soon be an unprecedented production. What effect this will have on the market remains to be seen. Copper has advanced 1½c, and is quoted at 21c per pound.

Spelter.—The situation is unchanged and the market continues to advance. The great strength of the market is due to the fact that the demand is greater than the supply. Producers are sold ahead to such an extent that urgent requirements cannot be covered. Spelter has advanced 2c and quotations are nominal at 15c per pound.

Lead.—The market is quiet and easy, quotations are unchanged at 5¾c per pound.

Antimony.—Heavy buying continues and the market is very strong. There is just as heavy a demand for futures as for prompt delivery, so prices are bound to go higher. Antimony has advanced 5c and quotations are nominal at 35c per pound.

Aluminum.—The market is unchanged at 23½c per pound.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

TENDER forms, specifications and indents have been forwarded by D. H. Ross, Trade Commissioner at Melbourne, for equipment required by the Victorian and New South Wales railways. These tender forms have not yet come to hand but when received they may be inspected by interested Canadian manufacturers at the Department of Trade and Com-

merce, Ottawa. (Refer File No. 1435.) Particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:

Victorian State Railways, Melbourne.

No. 28,737. June 30, 1915—1-13-inch centre lathe.

No. 28,760. June 30, 1915—1-9 k.w. motor generator, with switchboard and accessories.

No. 28,771. June 30, 1915—1-7 h.p. electric motor and accessories.

No. 28,771. June 30, 1915—1-4 h.p. electric motor and accessories.

No. 28,771. June 30, 1915—1-3 h.p. electric motor and accessories.

No. 28,771. June 30, 1915—1-½ h.p. electric motor and accessories.

The departure of mails from San Francisco are indicated thus: From San Francisco—May 26, due Melbourne June 23. From San Francisco—June 8, due Melbourne June 29.

CANADIAN TRADE.

THE statement of Canadian trade, issued on April 27, shows a grand total for the fiscal year of $1,078,173,240, as compared with $1,112,562,107 for the previous year, a particularly good showing in view of the dislocation of the world's trade by the war, and the unfavorable economic conditions which prevailed before the war.

In the last month of the year a very decided improvement was noticeable, the trade total being $110,540,998, as against $92,887,053 in March, 1914.

Imports for the year amounted to $587,364,363, and domestic exports to $409,419,503. In 1914 the imports were $633,564, and the domestic exports, $431,589,658.

March imports, which were $54,520,229 in 1914, declined to $40,858,179 in 1915, but the exports of domestic products showed a marked increase, the figures being $26,701,026 in 1914, and $45,118,922 in 1915. Imports of coin and bullion for the year were $131,992,922, as against $15,235,305 in 1914.

The statement is particularly interesting in its reference to exports for the month of March, exports of manufactures having increased from $6,239,290 to $15,600,790, agriculture from $6,512,346 to $12,438,145, and animals and animal products from $3,202,060 to $5,471,249.

WAR MATERIAL REQUIRED.

A LETTER has been sent to James Day of the firm of Day, Ferguson & O'Sullivan, barristers, Toronto, by W. H. Pauling Emerich, 26 Ave. de l'Opera, Paris, in which he states that he is in the market for large quantities of war material.

Mr. Emmerich impresses that the matter of supplies of guns and cartridges is urgent, as it is said the American Government may prepare for difficulties in the Pacific and in that case the export of arms may be stopped, the Government requisitioning everything. The writer states that he has a deposit in the bank of a million francs as guarantee for provisional contracts, and as soon as he has offers, the buyers will sign provisional contract and give the sellers five or six days to put up a bond in the sum of 5 per cent. of the deal guaranteeing execution of contract. The bank holding guarantee bond in New York will confirm deposit to Lloyds, Paris, and the buyer will sign contract, make deposit of 10 per cent. in cash and give bank credit for total of the amount of the contract. Prices to be quoted f.o.b. New York, and deliveries will be accepted in New York and goods paid for against documents.

Mr. Emerich goes on to say that "my people will buy all the guns and all the cartridges you can offer for delivery monthly from April 15 to end of September. The guns should run 50 to 90,000 per month and the cartridges one to three million a day. It is understood in making your offer you guarantee the guns and cartridges to conform to specifications of country buying. They must be sold by neutral or allied citizens, and here we demand guarantee they are for allied or neutral governments.

My buyers here are financial groups who buy in their own name, put up money and security and sell to governments. Your sellers must bill at price indicated by us and agree to pay difference to parties indicated by us." List of guns, cartridges, etc., is enclosed with cable explanation to be used. All the explosives that can be secured for quick delivery can also be used at once. The code and telegraphic instructions will be at their disposal in Mr. Day's office.

MANUFACTURE OF ARMAMENTS.

The importance of the supply of armaments was set forth very frankly by Lord Kitchener in the British House of Commons recently, when he said it was absolutely essential not only that the arrears in the deliveries of our munitions of war should be wiped off, but that the output of every round of ammunition was of the utmost importance. He made what will be regarded as a classic statement when he went on to say:—

I feel strongly that the men working long hours in the shops by day and by night, week in and week out, are doing their duty for their King and country in a like manner with those who have joined the Army for active service in the field. They are thus taking their part in the war and displaying the patriotism that has been so manifestly shown by the nation in all ranks, and I am glad to be able to state that his Majesty has approved that where service in this great work of supplying the munitions of war has been thoroughly, loyally, and continuously rendered, the award of a medal will be granted on the successful termination of the war.

WOULD STOP U.S. SHELL SHIPMENTS.

A COMPLAINT was filed on April 29, under the so-called "discovery" statute of Wisconsin to secure information to determine whether the Allis-Chalmers Co., a corporation, Otto Falk, its president, and others have entered into a conspiracy with the Bethlehem Steel Co., and others not yet known, to manufacture and ship shrapnel shells to European belligerents, contrary to the Wisconsin law.

The complaint was filed by Samuel Pearson, who declares he is a citizen of the United States and that he has valuable property interests located within the boundaries of the German Empire; that he is owner of securities issued by the German Government: and that the German Government is and for some time past has been engaged in war with Great Britain, France, Serbia, Montenegro, Russia and Japan.

The complaint sets forth that it is the belief that the defendants have entered into an unlawful conspiracy with the Bethlehem Steel Co. and others, and that such conspiracy indicated is made a criminal offence under the laws of Wisconsin, the penalties for which are defined in the Wisconsin statutes.

The complaint states that one type of ammunition indispensable to the belligerents is a projectile known as the shrapnel shell, designed but for one purpose, the destruction of human life and property, and that the intent of the war now being conducted by the several countries named against the German Empire is so to cripple the said empire by destruction of the lives of its citizens and of its property. A hearing has been set for May 5.

MADE-IN-CANADA CAMPAIGN.

A COMMITTEE of the Canadian Manufacturers' Association is endeavoring to raise money to advertise Made-in-Canada goods. In theory the proposal is excellent but in practice is it really wise? Most

Canadian manufacturers take a pride in their products, put their names on them and turn out something that is equal to and in not a few cases superior to anything of the kind produced in the world. On the other hand there are some Canadian manufacturers who unfortunately think their own interests are best served by making the cheapest and most inferior article they can force upon the buying public. They think a slightly greater immediate profit is better than building up a reputation for high-grade goods. These experiences and the exposures in connection with inferior qualities supplied to fill war orders show that there are some Canadian manufacturers who ought to be heartily ashamed of themselves and to be reckoned unworthy of patronage.

Even members of the committee recognize this weakness. Only the other day one of them placed an order amounting to several thousand dollars with a United States firm though the same products are made by another member of the association in a near-by town. The first manufacturer would much prefer to buy Canadian make but he knows from costly experience that his neighbor is too indifferent to take pains and turn out a satisfactory quality.

A general campaign of advertising Made-in-Canada goods would be paid for largely by the firms who are making high-grade goods, while the benefit of such a general campaign would be derived chiefly by the men who are trading on Made-in-Canada reputation and producing inferior goods to sell at slightly lower prices.

The committee of the Canadian Manufacturers' Association would be far better occupied and could do more real good to our various industries if they were to devote their energies to improving the quality—by moral and other influences—of the goods produced by their confreres who now injure the good name of Canadian manufacturers generally.

Canadian manufacturers who produce an article of which they are proud, behind which they will stand, should let the public know of it. They should advertise it extensively over their own names and not pay and be sponsors for the firms who have no care for their own or our national reputation.

"REMEMBER THE SABBATH DAY!"

AS to total prohibition, says an Old Country exchange, it seems to be now out of court—even as applied to war munition areas. Indeed, there is a growing disposition to question whether too much of the fall in output has not been attributed to the drinking customs of a minority of the workers and too little to the growing fatigue consequent on long spells of work at high pressure. In this connection, Lord Inverclyde has suggested the abandonment of Sunday labor so that the output of the other six days of the week might be improved. His lordship is evidently one of those who realize that the Fourth Commandment means more than the average Sabbatarian thinks it does, and that its wise observance is necessary to even the physical well-being of the race.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Calgary, Alta. — The Calgary Ironworks will manufacture shells.

Brantford, Ont.—The Waterous Engine Works have received an order for shells.

Lethbridge, Alta.—G. Kischel has leased the Lethbridge Iron Works, and will run the plant as formerly.

Zurich, Ont.—It is proposed to install a fire protection system. A tank will be required, also a gasoline engine and pump.

Moose Jaw, Sask.—The Saskatchewan Bridge & Ironworks, Ltd., have received a contract for 50.000 shells. G. E. McClellan is president of the company.

Charlottetown, P. E. I.—The Bruce-Stewart Co. have started to rebuild their foundry which was destroyed by fire recently. Lowe Bros. are the contractors.

Toronto, Ont.—G. B. McGregor, of the Ford Motor Co., states that the company propose to establish plants at Winnipeg and Calgary, and possibly at Vancouver.

New Westminster, B.C.—The Heaps Engineering Co., which recently went into liquidation, has received an order for shells. An effort is being made to reorganize the concern.

Vancouver, B.C.—Orders for shells have been distributed among the following: Vancouver Engineering Works, the Terminal City Iron Works, Ross & Howard, Letson & Burpee, the Wallace Shipyards, the B. C. Marine Railway Co., the Vulcan Iron Works and the Heaps Engineering Co., of New Westminster.

Municipal

Parry Sound, Ont.—Tenders are being received for a steel water tank having a capacity of 150,000 gallons.

Stratford, Ont.—Council will have a by-law prepared to authorize the borrowing of $50,000 to erect a water tower at the city pumping plant.

Ridgetown, Ont.—A by-law will be voted on by the ratepayers on May 10, to raise $12,500 to meet the cost of remodelling the present lighting system for hydro-electric power.

Toronto, Ont.—York Township Council are working on a plan for improving the water and sewerage systems.

Joliette, Que.—The town council contemplates installing a street lighting system at an estimated cost of $6,000.

London, Ont.—The Utilities Commission will meet on May 6, to open tenders for the new hydraulic machinery for the Springbank pumping station. M. Glaubitz is manager of the waterworks department.

Berlin Ont.,—The Water Commission has investigated various sources of water supply in the vicinity of this city. It has been decided to sink several wells near Bridgeport, where there are a number of natural springs.

Electrical

Niagara Falls, Ont.—Work has commenced on the new ornamental street lighting system.

Owen Sound, Ont.—The hydro-electric high power line from Eugenia Falls generating station to Owen Sound is partly completed, eleven miles having been erected.

General Industrial

Port Elgin, Ont.—The Stephens-Hepner Co. propose to extend their broom factory.

Ridgetown, Ont.—Fire destroyed A. S. Blight's flour mill here on April 29. The damage is estimated at $20,000, about half that amount being covered by insurance.

Port Arthur, Ont.—The National Elevator, owned by the National Elevator Company of Winnipeg, located on the C. N. R. tracks, was completely destroyed by fire on May 2. The plant was worth about $100,000 and insured for about $60,000.

Deseronto, Ont.—This town is to have a match factory conducted by the Rathbun Match Co. The capitalization is $125,000. The officers of the new company are: President and treasurer H. W. Rathbun; manager, G. G. Gardiner; secretary, L. E. S. Hodge.

Lethbridge, Alta.—The Ellison Milling Co., of this town, has decided to rebuild the elevator at Magrath recently destroyed by fire, together with the mills of the company which were located there. The mills will not be rebuilt. The new elevator will have a capacity of 40,000 bushels.

Lindsay, Ont.—It is understood that the amalgamation of the Lindsay Library & Office Fittings Co. with the Capital Office Fittings Co., of Ottawa, is practically completed, and that the Lindsay branch, which will comprise the manufacturing end of the business, will commence operations about May 1.

Building Notes

Mimico, Ont.—For additions to the public school, the Village Council has passed a debenture by-law for $17,200.

Toronto, Ont.—The Bell Telephone Co. has secured a permit from the City Architect's Department for the erection of an exchange at North Toronto, the building to cost about $31,000.

Toronto, Ont.—The Toronto Hydro-Electric system has been granted a permit by the City Architect's Department to erect a two-storey brick and concrete electric power station on the south-east corner of Gerrard street and Carlaw avenue at a cost of $65,000. Tenders for the construction of the station will be received until May 13. Specifications, drawings and form of tender can be seen at the Toronto Hydro-Electric System sub-station, corner Duncan and Nelson streets.

Toronto, Ont.—The building operations now being carried on by the Toronto Board of Education total $1,555,000. The list includes the following new schools, additions, and annexes: Additions are being made to Leslie street school, $54,000; Regal road, $105,000; North Toronto High School, $55,000; Roden, $35,000; John Fisher, $50,000; Withrow, $50,000; Bedford Park, $28,000. Annexes are being built for: Ryerson, $60,000; Essex, $67,000; Palmerston, $58,000; Brock, $55,000; Huron, $35,000. The new buildings which are being put up are: The Administration Building, for which tenders are to be opened to-day, $100,000; Commerce High School, $280,000; Niagara, $110,000; Davisville east, $50,000; Leslie street north, $59,000; Runnymede, $57,000; Givens, $180,000; Pape avenue north, $57,000.

Tenders

Orillia, Ont.—Tenders will be received until May 17, for centrifugal pumps and motors, cast iron pipe and a Venturi meter. Specifications at the office of F. Gover, sec'y-treas., Water, Light and Power Commission, Orillia.

Transcona, Man.—Tenders will be received up to May 15 for the supply and erection of pumps and motors, etc. Plans and specifications may be obtained from W. M. Scott, engineer, 204 Sterling Bank Building, Winnipeg, Man.

Brockville, Ont.—Tenders will be received up to May 17 for the construction of a mechanical filtration plant. Plans and specifications may be seen at the office of G. H. Bryson, Town Engineer.

Toronto, Ont.—Tenders will be received up to May 11 for the supply and installation of one sludge pump and motor for the main sewerage disposal works, Toronto. Specifications may be obtained at the Works Department, City Hall.

Toronto, Ont.—Tenders will be received up to May 11, for the supply of: No. 48.—Red lead paint for Bloor street viaduct; 50.—Ashphalt pump outfit for city plant, Princess street; 51.—Additional equipment for car bodies, Lansdowne avenue car line extension, Toronto Civic Railway; 52.—Car heaters and seats, Gerrard street equipment. Specifications and forms of tender may be obtained at the Works Department, City Hall.

Trade Gossip

The Western Foundry Co. has increased its capital stock from $150,000 to $200,000.

The Exolon Co. of Welland, Ont., has received a supplementary license to use capital in Ontario to the extent of $175,000.

Steel Co. of Canada.—On April 29 the annual meeting of the Steel Company of Canada was held at Hamilton. All the directors were re-elected and the officers also. Charles S. Wilcox is president; Cyrus A. Birge, vice-president; and Robert Hobson, vice-president and general manager.

The Goldie & McCulloch Co., Galt, Ont., have sold the following equipment to the Toronto Board of Education for the new Technical School: One 50 k.w. high-speed, horizontal, 10 in. x 12 in. centre-crank engine, and one 365 h.p. vertical, high speed compound, 15 in. and 25 in. x 10 in. engine.

Purchasing Commission.—The personnel of the Canadian Government Commission, which is to make all purchases under the $100,000,000 war appropriation passed at the recent session of Parliament, is announced, and consists of George Gault, Winnipeg; H. Laporte, Montreal; and A. E. Kemp, of Toronto.

Big Contract for Cement.—The Dominion Government has awarded the Canada Cement Company of Montreal a contract for 2,500,000 barrels of cement. Next to the contract for cement for the Panama Canal, this is the largest order ever given for this commodity. The cement will be used in Welland Canal extensions.

Placing Big Shell Order.—Senator Curry, president of the Canadian Car & Foundry Co., and F. A. Skelton, secretary-treasurer, have gone to New York on business in connection with the company's Russian shell order. The entire $80,000,000 order, Canadian and American end both, will probably be placed within the next few days.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British.—Lieut. Johnston and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Shell Manufacture Out West.—Professor Stansfield, head of the metallurgical faculty of McGill University; A. W. G. Wilson, chief metal engineer of the department of mines, and Mr. Carnegie, a shell expert—all three of whom are representatives in Canada of the British shell commission—have arrived in Victoria, B.C. They are making exhaustive inquiries throughout the Dominion for the purpose of determining what facilities offer for producing shells on a large scale, and they are paying particular attention to the copper, zinc and lead output of British Columbia. The party visited Trail, B.C.

War Orders Speculation.—Whether the war order benefits are being too liberally discounted by Stock Exchange speculation remains to be seen, yet there can be no doubt that big business is being executed. The Government committee which has been handling the shell orders for the British War Office reports that the business placed in Canada amounts to $170,000,000, which, added to the Russian orders, makes a total that cannot be too lightly regarded in relation to Canadian trade—and shells have not been the only lines in which Canadian manufacturers have benefited.

Personal

James Stewart, until two years ago chief engineer of the Western Canada Flour Mills at Goderich, Ont., died at that place on April 26, aged 73.

Capt. K. S. MacDonnell, for several years town engineer of Barrie, Ont., is leaving shortly for the front in command of a company taken from the 37th Battalion.

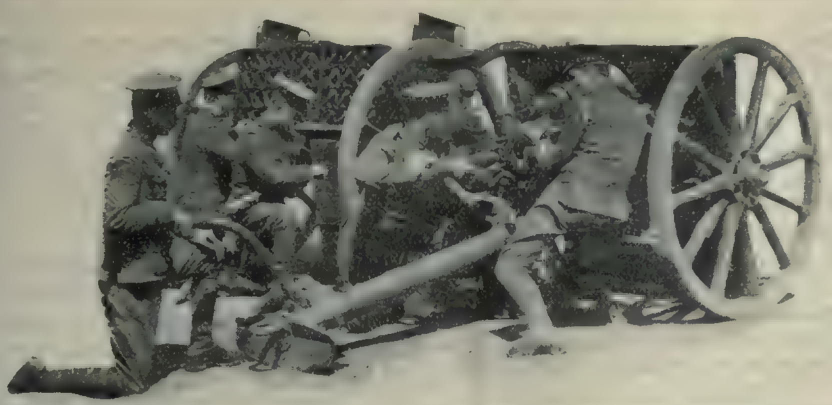
H. Osborne has been appointed works manager of the Angus shops of the C. P. R. at Montreal. The Angus shops district has been operated as a separate unit, but will henceforth form a part of the Eastern Lines.

C. A. Ablett, general manager of the Siemens Company of Canada, Ltd., Montreal, has resigned and has sailed for England to obtain a commission in an English regiment. W. Hoult succeeds Mr. Ablett as general manager.

Frank E. Mutton has been appointed secretary and general manager of the International Time Recording Co., of Canada. For the past three years Mr. Mutton has been managing director of J. J. Gibbons, Ltd., Advertising Agents, and previously was manager of the National Cash Register Co., in Canada.

T. H. Wardleworth, of the National Drug & Chemical Co. of Canada, Ltd., was recently elected by acclamation, chairman of the Montreal Branch of the Canadian Manufacturers' Association, stepping up from the vice-chairmanship, which he has held for the past year. George A. Slater, of George A. Slater, Ltd., was elected vice-chairman, also by acclamation.

J. A. Shaw has been appointed electrical engineer of the C.P.R., according to a circular just issued by W. E. Woodhouse, the chief mechanical engineer. Mr. Shaw joined the service in 1904 as assistant electrical engineer of motive power at the Angus Shops, and in 1908 was made electrical engineer of Eastern Lines. His new appointment gives him authority over all the lines of the C.P.R. Mr. Shaw carried out the important electrical work of the new C.P.R. bridge over the canal at Lachine.



Guns and Their Up-to-Date Development*

By Lt.-Col. F. M. Cole**

Secondary only, if even that, to the interest in the manufacture of shrapnel and high explosive shells by our engineering plants, is that of the guns employed to discharge these and other type projectiles. The historical sketch forming the subject matter of this paper will therefore be found opportune, interesting and instructive at this juncture.

BEFORE the invention of gunpowder, machines of various construction were used by the ancients to hurl projectiles against the enemy. They were principally employed against fortified places, and some of the machines were of huge size. The principal ones were the Catapult and the Ballista. The propulsive power in both was the elasticity of cords formed of the bowels of animals, sinews, human hairs and hemp, twisted into a spring that could be released by a trigger-catch. The Roman Ballista was the siege gun of the ancients. It was built in various sizes, the largest being powerful enough to hurl a stone, weighing 300 pounds, a distance of 500 yards.

Gunpowder.

Gunpowder is supposed to have been invented by the Chinese long before it was known or used in Europe. If we go back nearly 600 years we find a representation in an illuminated manuscript made during the reign of Edward II. (1326), showing a knight in armour firing a short primitive weapon, shaped like a vase, loaded with an incendiary arrow.

Guns were at first constructed of wrought iron, and were made of large bore to fire heavy stone shot. The second epoch may be taken as dating from about 1520 to 1854, during which period cast iron shot were generally employed and the guns were made either of cast iron or bronze. They were much better proportioned than at the beginning.

The third or present epoch may be said to have commenced in 1854, when elongated projectiles and rifled guns began first to come into use. The rapid progress made during this period is as remarkable as the unproductiveness of the second epoch. Even during recent years the call for greater power has produced results which were believed to be impossible in 1890.

ORDNANCE, B.L., 60-PR., MARK I.

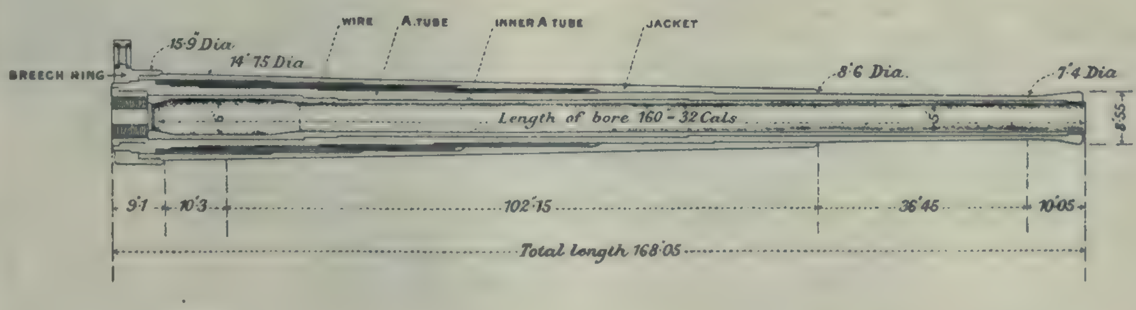


Plate 1

The early guns were made without trunnions. The huge gun, "Mons Meg," in Edinburgh Castle, has a calibre of 20 inches and fired a granite stone weighing 320 pounds. The gun was built up of

*From a recent paper before the Canadian Railway Club.

**Late C. O. Montreal Heavy Brigade, Canadian Artillery.

wrought iron longitudinal bars arranged like the staves of a cask and welded together, with external rings of wrought iron driven or shrunk on.

Bronze Guns.

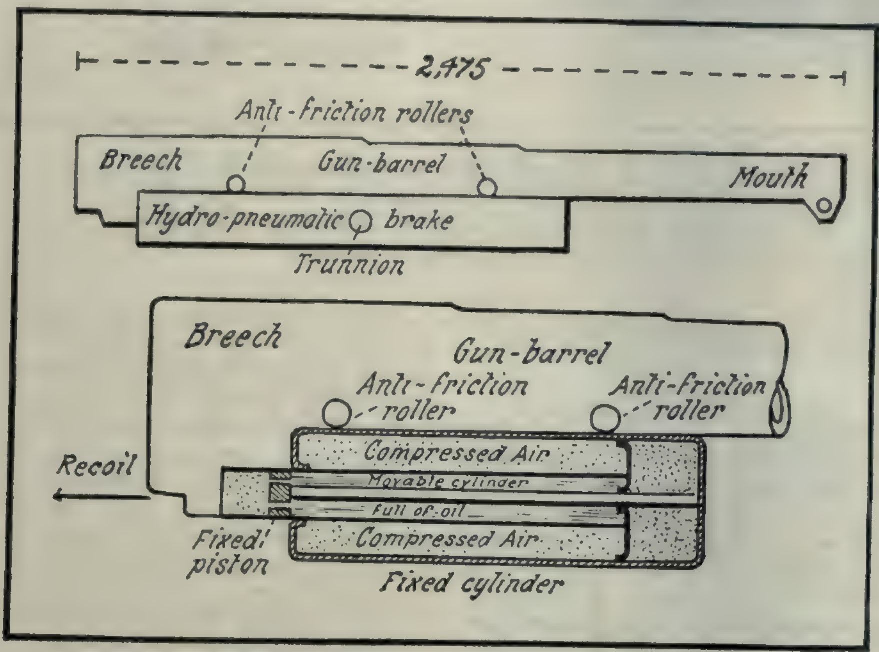
Bronze guns of about the same dimensions were cast about 1468 at Constantinople. One of these is now in the Royal Military Museum at Woolwich, a most interesting place, containing samples of the ideas of inventors for generations, and after my first visit to the museum I came away fully convinced that there was nothing new under the sun.

Some of these old guns at Constantinople were used against the British squadron, under Admiral Sir John Duckworth, who forced the Dardanelles in 1807. In this engagement, six men-of-war were damaged and some 126 men killed or wounded. The guns were too unwieldy to lay for each round, and were consequently placed in one position bearing on a strategic point and sometimes kept loaded for months.

The guns referred to were muzzle-loaders and were fired by means of a vent in the breech into which loose powder was poured from a horn. There are guns stored to-day at St. Helen's Island, Montreal, each with a powder horn and an iron rod known as a portfire as part of its equipment. In the end of the rod was inserted a slow burning composition, which was kept alive as long as required; this touching the vent when the order to fire was given.

Gun Definition.

The word gun is a general term for a weapon, tubular in form, from which a projectile is discharged by means of an explosive. In time it has come to be restricted to the heavier weapons used by artillery as distinct from small arms. When applied to artillery, the word is confined to those pieces of ordnance which have a direct as opposed to a high angle fire, in which later case the terms howitzer and mortar are used. Gunnery is the science of directing a projectile so that it will strike a given target.



DETAILS OF THE HYDRO-PNEUMATIC BRAKE OF THE "75."

The gun serves two purposes. First, to confine the powder gases so as to allow them to act upon the base of the shell; and, second, to give the shell the proper direction. As the powder charge burns, it is converted into gas of greatly increased volume. This gas, in its endeavor to expand, presses upon the base of the shell and drives it up the bore. So long as it continues to exert a forward pressure upon the base of the shell, it continues to accelerate the motion of the shell, and the latter goes on increasing until it passes out of the muzzle, and the pressure on its base ceases.

Capacity of Gun.

Colonel Bethell, of the Royal Artillery, who is an authority, puts it thus:—

"We should get the greatest possible effect out of a charge of powder if the gun were made long enough to contain the whole of the powder gases, so that the forward pressure on the base of the shell would cease just as the shell reached the muzzle. Such a gun would, however, be unwieldy, and in practice we cut the gun short and allow a good deal of gas pressure to go to waste out of the muzzle."

The efficiency of any weapon depends entirely on two factors:—1—Its power to destroy men and material; 2—the moral effect of gun fire, which is of great importance. When guns were first used, the noise they made on discharge must have produced a bewildering fear in those without previous experience of them. Villani wrote of the battle of Cressy that the "English guns made a noise like thunder and caused much loss in men and horses."

Foreign founders were brought to England about 1540 for the purpose of teaching the English the art of casting guns. The "Mary Rose," which sank off Spithead in 1545, had on board both breech-loading wrought iron and muzzle-loading bronze guns. The long bronze gun in Dover Castle has a calibre of 4.75 inches and its total length, including the cascable (the part which projects in rear of the breech), is 24½ feet. This may be the gun which carries the inscription: "Load me well and keep me clean, I'll carry a ball to Calais Green." I do not think, however, that a projectile has yet reached the continent fired from any part of England. We know that our present enemies are desirous of experimenting from Calais with a view of dropping something more modern than round shot and larger than Zeppelin bombs on the Dover coast. The campaign, however, has not yet developed in the direction which would enable them to test their guns at this point.

Little or no classification of the various types of guns was attempted during the 15th century. The following century saw some attempt made at uniformity and the division of the several calibres into classes, but it was not until 1739, when Maritz, of Geneva, introduced the boring of guns from the solid, that actual uniformity of calibre was attained, as up to this date they were cast hollow and discrepancies naturally occurred. During the 18th and first half of the 19th century no change of importance was made. Better methods of manufacture had improved gunpowder and the windage between the shot and the bore had been reduced.

Gun Equipment.

The earliest guns were not provided with sights or means for directing them, but this was not important, as the range seldom exceeded 100 yards. The direction for line was easily obtained by looking over the gun and moving the carriage trail to the right or left as was necessary. For elevation, an instrument was used later called a "Gunner's Quadrant." This was a graduated quadrant of a circle connecting a long and short arm forming a right angle; a line with a plummet hung from the angle in such a manner that on the long arm being placed along the bore near the muzzle the plummet hung down

against the quadrant and indicated the degrees of elevation given to the piece. Later on, tangent scales were used which fitted into sockets on the breech. These were used in conjunction with the dispart foresight and gave elevation up to 4 or 5 degrees over the top of the gun. When rifled guns came in, the holes for the tangent sight bars were inclined to compensate for the drift of the projectile.

The portion of the bore of a gun nearest the breech, which contains the powder charge, is called the chamber. The powder does not completely fill the chamber, nor is it a solid mass. If a charge of cordite were compressed into a solid block it would be found to fill only about one-third of the chamber. On ignition, the powder gases first fill the chamber, and more and more gas is generated by the burning of the charge until the pressure in the chamber overcomes the resistance of the driving band and the shell begins to move. This, in a field gun, occurs when the pressure rises to about 1½ tons to the square inch. Henceforward the powder pressure acts as an accelerating force upon the shell till the latter leaves the muzzle.

Pressure in Bore.

Forty years ago, the only explosive used in guns was coarse black powder. The whole of the charge was converted into gas immediately on ignition, thus developing a very heavy pressure in the powder chamber, which rapidly fell as the shell moved up the bore. Guns of this period were, therefore, made of a very pronounced bottle shape, enormously thick at the breech. As an improvement, pebble powder was devised. This consisted of cubical grains of from ½ inch to 1½ inches. These burnt more slowly, giving less pressure at the start and a better maintained pressure as the shell travelled up the bore. Guns were then made thinner at the breech and thicker towards the muzzle.

Prismatic powder, pressed into large six-sided prisms, was the next step, and this was followed by slow-burning brown powder, known as cocoa powder. Now we have smokeless powder, in thick cords, tubes or tapes for long guns and fine strings for short ones. This has enabled us to adjust the pressure in the bore so as to get the maximum of work out of the gun with the minimum of metal.

The Armstrong system of breech-loading, introduced in 1854, was the first to give satisfactory results. It was simple in design and extremely accurate results were obtained in shooting. It took time, however, to screw and unscrew the breech. A later invention, the "interrupted screw," got over this difficulty and enabled the swinging block supported on a hinge to be closed and locked by a quarter turn. The breech screw is supported by a frame called the carrier pivoted to the breech of the gun at one side. Two other breech actions are in use on modern guns, namely—(a) the wedge, and (b) the eccentric screw. The former action is still a favorite in Germany, and has the merits of strength and simplicity. The latest British movable gun is now in the field in France.

Sights.

The theory of the action of sights is simple enough when applied to the arc sight, which has superseded the old tangent scale, and the improvements in the accuracy and rate of fire of modern field guns have led to the introduction of more perfect sights. In all of these, the object of the improvements is to facilitate the layer's work so as to make laying easier, quicker and more accurate, and to avoid as far as possible the chance of mistakes.

Perhaps no adjunct of the gun shows such great improvement in recent years. It may be sufficient to say that the addition of the telescope and the attachment of the sights to non-recoiling portions of the carriage account to a large extent for the accuracy now obtainable, even at long ranges and with indirect laying. The term "indirect" is applied to the method of laying guns in which they are

FRENCH FIELD ARTILLERY FIRING BY "RAFALES" OR "GUSTS" WITH INCREASED ELEVATION. THIS METHOD SOON RENDERS AN ENEMY'S POSITION UNTENABLE.

not aimed upon the target to be attacked by direct vision.

Indirect Laying.

As a typical case, suppose the battery in action to be behind a hill, trees, houses, or other cover from view. The battery commander is posted sufficiently far to the front to see the target. From this point, known as the observing station, the battery commander directs his battery, either by telephone or by semaphore code.

In the present war there has been hardly any direct laying and the battery commander has usually been obliged to get a considerable distance in front of his battery to obtain a suitable observation station from which he communicates with it by telephone. It has been found necessary to have the guns completely dug in with a screen of some sort overhead in order to hide them from aerial observation. In the first part of the war, it was stated that 70 per cent. of the casualties among the Allies was due to artillery fire. I was present at Lydd, on the Kentish Coast, a few years ago for howitzer practice, and during night firing the average error of the guns—that is, the distance apart of the spots where the shells fell from the same gun fired at the same target, was less than five yards. To show the accuracy of the guns now in use, it has been stated that guns of the heavy artillery in recent actions in France have shown an average error of less than three yards.

The Material Feature.

Since 1880, the steel industry has made so much progress that this material now regarded as the metal most to be elied on. The long high-power guns, however, require to be worked at a greater chamber pressure than the older breech-loaders. A stronger material than ordinary carbon gun st vas consequently demanded from the steel makers, in order to keep the weights of the heavier guns within reasonable limits. The demand was met by the introduction of a gun steel having about 4 per cent. of nickel in addition to about 0.4 per cent. of carbon. This alloy gives great toughness and endurance under a suitable oil hardening and annealing process, the yielding stress being about 26 to 28 tons and the breaking stress from 45 to 55 tons per square inch.

The 4.7 gun weighs 42 cwt., and is constructed of steel. It consists of an A tube, around a portion of which are wound successive layers of flat steel wire. The jacket is fitted over the exterior of the wire and a portion of the A tube, and is secured longitudinally by corresponding shoulders and the breech ring which is fitted over the rear end of the A tube and screwed to the jacket. The B tube is shrunk over the A tube in front of the jacket.

The 18-pr. Q.F. gun is constructed of steel, and consists of the A tube, a series of layers of steel wire, jacket and breech ring. The A tube extends from the rear end of the chamber to the muzzle. The weight with breech fittings is 9 cwt., and the length 97 inches. This is the gun of our field artillery.

France's Pet Gun.

The glory of the French artillery is the 75 MM. field gun, whose very existence was a jealously guarded secret until the war made concealment no longer possible. Thirty years ago the French artillery experts set to work to produce a gun which could duplicate on land the rapidity and accuracy of the Canet and Hotchkiss naval guns. It was understood that Krupps had undertaken the construction of such a weapon, and the French War Office sent for Major Deport, asking him if he could not invent a gun on the basis of a "long recoil."

> **KNOW EVERYTHING—UNDERSTAND NOTHING.**
>
> **"The Germans have at Berlin the most complete bureau of information to be found anywhere in the world. They know everything and understand nothing. They had no measurement in Germany to gauge the soul of a nation such as that of the British Empire," declared C. W. Barron, in his address before the Montreal Canadian Club.**

In a short time he submitted a field gun able to fire twenty-five rounds a minute. Its accuracy was perfect, and its stability was such that the two principal gunners could remain seated on the gun carriage during firing. Thus the "75," as it is commonly called, was born, and has proved to be everything the most exacting gunner could desire.

We all know what results have been achieved with the French field gun in the present war, and from all accounts our own 18-pounder field guns have proved an admirable and most satisfactory weapon. In its results, so far as we can judge, it is not far short of the French "75."

British Modern Guns.

The modern guns in use by Great Britain in the present war range in size from the 16 and 15-inch naval guns with which the "Warspite" and "Queen Elizabeth" and their sister ships are armed to the one-pounder quick-firing guns used on shipboard, as well as for land defences. I am not referring to the machine guns which are attached to every infantry unit. A diagram in a recent illustrated paper showed that a ship of the "Queen Elizabeth" class could from a point in the English Channel south of the Isle of Wight fire directly over the island and across Southampton water and drop shells in the town of Southampton, a distance of twenty-five miles. In the two days' battle of Neuve Chapelle, in which our own field artillery participated, 500 guns were in action on the side of the Allies.

INCREASING THE OUTPUT OF MUNITIONS.

AS is well known, the doing of repetition work on machines not made for it can very often be immensely facilitated by contriving suitable appliances, in the shape of jigs, chucks, fixtures, punches, clamps, drills, cutters, grinding wheels or gauges, and by discovering quick ways, methods, and sequences of performing the necessary operations.

Just now, says a writer in the "Manchester Guardian," every other machine shop in the land is wrestling with the problem how to adapt machine tools originally made for general work, or for special work of a different nature to the manufacture of munitions, and each shop is having to discover the various kinks for itself to the best of its unaided ability. This is not only a needless reduplication of labor, but also a serious impediment to production, for the contrivers of first-rate kinks and tip-top methods are not to be found in every shop, and the average shop has perforce to rub along with the fair-to-middling appliances of its own devising.

In a great national task such as this, the best should be the common property of all. The new Committee on Munitions would do well to send a Commissioner round all the best general shops engaged on ammunition work, shops that have had some months to get into their stride, with instructions to find out and set down in detail, with drawings and photographs, every helpful device or practice that has been arrived at, and his report should be issued confidentially, with as little delay as possible, to every firm engaged on Government machine tool work.

The trouble and expense would be insignificant; there are no difficulties and no possible objections, while its helpfulness would be inestimable. If the responsible authorities will carry out the suggestion we are confident that a substantially increased production must ensue.

Shipbuilding steel contains about ¼ per cent. of carbon.

Every torpedo carries a certain quantity of ballast to keep it in an upright position.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

CHECKERED FINISH OF CASTINGS.

By D. A. Hampson.

THE checkered finish on the cast iron heads of squares and other tools serves a dual purpose. It looks nice and its very unevenness blinds the eye to little imperfections in the iron that would otherwise have to be covered up by filling, etc.

It is sometimes desired to make such a finish on a special job, but the evident cost of cutting all this on a pattern prohibits. A cheap and effectual way is to cover the surface of the pattern with a piece of leather having the right "grain." Another way, though not quite as good, is to cover with wall paper of this pattern; wall paper of this kind usually has a large figure, more like that in imitation alligator skin products.

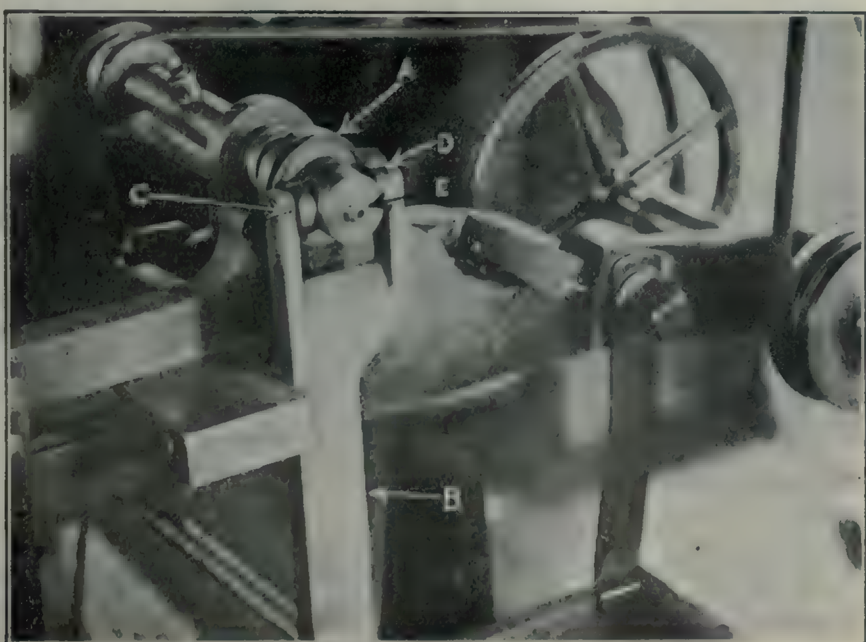
POLISHING SCREW HEADS.

By A. E. Granville.

ROUND screw-heads are generally a considerable bother to polish, as ordinarily they must be handled individually. There are some automatic polishing machines for this purpose but they are not in general use.

The machine shown was made in a shop turning out round head screws in considerable numbers. The spindle runs at high speed and the split collet opens outward and is fastened to the spindle. The closing ring is pressed outward by a spring, so that normally the chuck is closed when running and is only opened when the foot treadle is pressed.

The flange A is fastened to the closing ring and travels with the spindle, and the forked lever B carries two rollers C and D which press against the flange and force it back when the foot treadle is used. As the closing ring or sleeve is pressed back, centrifugal force spreads the jaws and allows the polished screw to drop out. The operator then inserts another one, releases the foot treadle and holds a piece of emery cloth against the screw head. Only an instant is needed to finish the work.



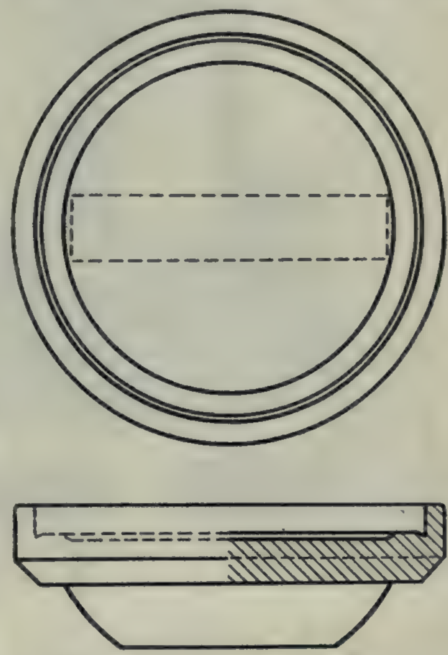
MACHINE FOR POLISHING SCREW HEADS.

PISTON-RING HOLDING BLOCK.

A. L. Loy.

FOR holding piston rings while being filed or having other hand work done on them, a wooden block with several finishing nails driven into same to correspond to the proper circle is generally used. It is an impossibility, however, to obtain a block which is absolutely plane, and a much harder proposition to keep it so when in constant use. The nails also do not bear evenly on the outside of the ring and, to say the least, it is most unsatisfactory.

The block shown in the cut was made of cast iron, being turned out to a slightly larger diameter than the ring so that it could be easily inserted and removed. A lug was cast on the back to provide a handle and for clamping in a vise. The centre part of the block was relieved and a chip groove turned in the corner to care for any dirt or feather-edge on the ring. The depth of the turned portion was about three-quarters the width of the ring. This held the ring in a true position while being filed, and corres-


PISTON RING HOLDING BLOCK.

ponded to the position which it took while in use in the cylinder.

Each assembler was provided with one of these blocks corresponding to sizes of engines built by him, With this, he was also given a cast iron block about ten inches square, similar to a surface plate, on which was pasted a sheet of fine emery cloth. This was used to true up the surface and take out the tool marks, or for dressing after filing. These blocks proved highly satisfactory to the assembler and a great deal of time was saved by having the proper sizes always at hand.

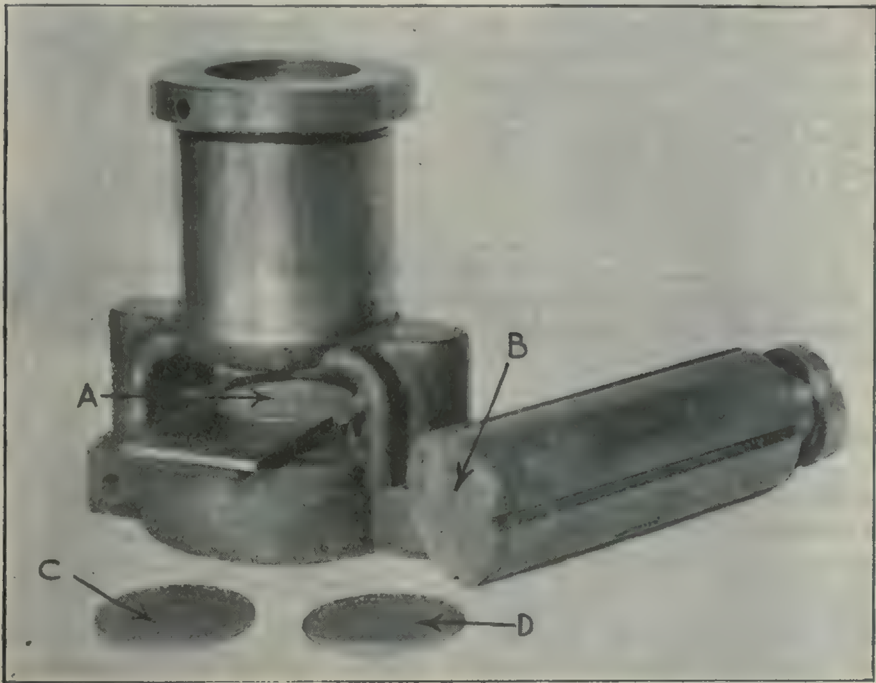
SPOTTING WATCH PLATES.

By E. G. C.

MOST watch factories put their watch plates in jigs for spotting, by which is meant just running a small drill in far enough to give a through drill a start. Owing to the smallness of the drills used, it is never advisable to try to drill through a plate held in a jig, as the slightest clogging will break the drill.

The spotting of the holes in a jig takes considerable time, even if the girl operators do work at lightning speed. The Illinois Watch Factory, Springfield, Il-

linois, has for sometime spotted their plates in a punch press, using the type of subpress shown. The plate to be spotted is placed at A and the punch is brought down on it. The end of this punch carries a steel plate studded with small steel points as shown at B, just long enough to make the desired impression. A blank plate is shown at C and a spotted one at D. Spotted in this way, an operator can turn out dozens while one was being spotted in the old way in a jig.



SUB-PRESS FOR SPOTTING WATCH PLATES.

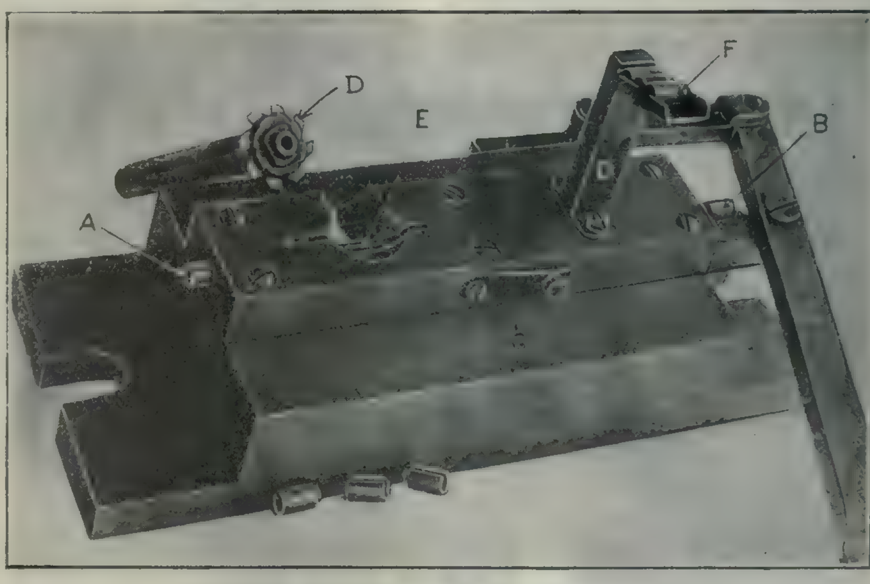
After the plates are spotted, the holes are drilled through, one at a time, and then each one is bored out accurately. This is done by placing the plate in a quill which centers one hole only, a separate quill or holder being provided for each hole to be bored. While this may seem a cumbersome method to the ordinary mechanic, it is the only way to obtain holes as accurate as are required in watch work at a reasonable speed. On some of the cheaper grades of watches, the holes are sometimes punched through, but this is not satisfactory and cannot be used for the better grades.

SLITTING SMALL BUSHINGS.

By A. L. B.

A MAGAZINE fixture used for slitting small bushings is shown in the accompanying halftone. The fixture is bolted to the milling machine table and set so that the cutter D will work in the slot E deep enough to slit the bushings as they are fed under it.

The bushings are placed in the magazine chute at F and are pushed along through the hole in the fixture by means of a plunger B operated by hand-lever C. As they feed on past the cutter, they drop out of the end of the hole at A. The spring G backs a pin that projects into the long hole through the fixture. This pin is beveled toward the magazine so as to allow the bushings to feed forward but prevents any tendency to slip back after one has once passed it. Bushings can be slit as fast as the operator can conveniently work the lever. While this was designed for small bushings, it can easily be adapted to large ones which are to be slit on one side only.



FIXTURE FOR SLITTING SMALL BUSHINGS.

The gun shield of an ordinary field gun is about $\frac{1}{8}$ ins. thick and the greatest distance at which a bullet will penetrate it is 600 yards.

THE NEED FOR MUNITIONS.

WHEN the attack was delivered on Neuve Chappelle, says Sir John French, "our artillery completely cut off the village from German reinforcements by a curtain of shrapnel fire." In war as it is to-day, adds the Commander-in-Chief, heavy casualties are absolutely unavoidable. The power of defence conferred by modern weapons lengthens battles and wastes life, but battles can be shortened and loss lessened if an "absolutely unlimited supply of ammunition" enables attacks to be supported powerfully by artillery.

Efficiency of Bath Lubrication.—In the Alfred Herbert Co. Monthly Review for March appears a short article dealing with the efficiency of bath lubrication. It is pointed out that it is sometimes stated in machine tool catalogues that oil bath lubrication of gearing reduces frictional losses. This statement, the writer remarks, is easy to make but very difficult to prove. It is quite easy to demonstrate that the frictional losses in, say, a lathe headstock or gear-box are increased instead of reduced by oil bath lubrication. The writer is a strong advocate of oil bath lubrication, but not because it reduces the total friction losses, but because by its use the life of the machine is lengthened, the attention required is much diminished, and the possibility of parts seizing is practically eliminated. It is found in practice that when a gear-box having bath lubrication is run at high speed it will always increase considerably in temperature, owing to the internal friction caused by the churning up of the oil by the gears. By running the same box with the oil drained out, the temperature falls and the power is reduced correspondingly.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

TO THE READER, THINKER AND WRITER.

By H. Westwood.

THERE is nothing in the engineering profession of greater value than the columns of correspondence we read from time to time in our technical journals, and I would take the present opportunity of requesting from fellow craftsmen even more frequent communications. Let us have all possible ideas. Criticise everything that appears open to criticism and if experience has taught you different, give the public the benefit of your wisdom. The mere fact of you finding any difficulty in committing your knowledge to paper need be no drawback. The journal wants ideas, not words, and if the brain work is there it will be put into proper shape.

Every issue there is correspondence offering controversy, which many of us can doubtless indulge in. The modern newspaper is the substitute for the ancient forum. Instead of a number of people meeting in some public place, as they used to do to discuss various questions of interest, they now write to their paper and interchange their views through the medium of its printed pages.

I believe that there is no better way of acquiring and disseminating knowledge than to establish a co-operation between those who read and write, to place the opinions of practical men beside those of the theorist, the worker beside the thinker, and thus obtain news clearer, better and more comprehensive on subjects interesting alike to all.

LAYING UP A HEATING PLANT FOR THE SUMMER.

By J. P. S.

THE approach of warmer weather means, among other things, that the fireman and, in some cases, the engineer must close up shop for the summer and hunt another job. To the transient and temporary man, the best manner of putting the plant and machinery away, is a matter of small moment, but to the lone man who stays on the job and is perhaps paid on the percentage of saving plan, the working condition of the plant for the next season is a matter of concern.

The treatment of the idle plant is important in that many vital parts, if neglected, deteriorate much more rapidly than when in use. The greatest destructive influence is, of course, corrosion and this is very hard to entirely prevent. The essential conditions for rusting or oxidation are dampness, air, and more or less warmth, and any means that will spoil this combination will achieve the desired end.

Steam and hot water plants necessarily require different treatments. In the case of a steam boiler alone, there are two methods of procedure. The boiler should be thoroughly cleaned and washed out in any case. It may then be very nearly filled with water, the remaining space being filled by a gallon or so of crude oil. The boiler may now be slowly drained and, as the water subsides, a coating of oil is left on all tubes and interior surfaces. The boiler is now sealed up as nearly air tight as possible.

The alternative is to fill the boiler nearly full of water, boil off the air, fill the boiler completely, add a little soda ash and seal it up. The outside parts should be cleaned of ashes, dust and particularly soot as the latter has a very strong attraction for moisture. Parts liable to rust should be painted with a good preventive of corrosion, and furnaces and building closed up. The top of the stack should be covered with a water-tight hood and all openings by which rain or other moisture may reach the boiler or breeching must be effectively closed. All external polished parts of brass or steel should be painted with vaseline or a mixture of white lead and tallow.

In the case of a steam heating plant as well as a hot water system, a difference of opinion exists among the best authorities. It has been shown, however by reliable tests that the average plant lasts from 15 to 20 per cent. longer when put away full of water. When doing this, the water should be boiled, if possible, to remove the air and more soda should be added when the water has not all been boiled. In the heating plants of high buildings, the head of water caused by filling the system may cause severe strains and consequent leaks in the lower pipes. Again, there is a continual danger of accident happening to the lower pipes during the summer with the result of flooding the building.

One of the best mixtures for painting smoke pipes, breechings and other parts after cleaning is ordinary boiled oil to which has been added enough good quality plumbago to give the consistency of a thin paint. This prevents rust, gives a good appearance and does not smell badly when the fire is started up.

Unfortunately the care given to a heating plant does not show immediate proportionate results. The conscientious engineer however, has the satisfaction of knowing that he is making easier the lot of the man who comes after him and may possibly be doubling the life of his plant.

DYNAMO GENERATION FAILURE.

WRITING in the columns of Vulcan, Dr. Worrall says a dynamo will sometimes run quite satisfactorily day in and day out, but one time when it is required not a volt will it generate. The residual magnetism in the field magnets generate perhaps only five or ten volts when the dynamo is running at full speed, and this slight pressure causes a current to flow through the magnet coils, which increases the magnetic field and causes a greater pressure to be generated, which again increases the field current, and so on until the full pressure is generated.

If the resistance of the field circuit is much greater than the normal, the small pressure generated by the residual magnetism will be insufficient to excite the machine and cause the magnetic field to build up. The resistance may be increased by dirty or loose contacts, broken or cracked wire, perhaps inside the insulation, a dirty commutator, high mica in the commutator. The trouble may also be due to a reversal of the field connections. If the entire armature is short-circuited, the pressure generated by the residual magnetism will cause an internal current to flow in the armature, and none will flow through the parallel circuit of the shunt field. Various other suggestions are also made.

Large Chain Drive Transmission.—What is claimed to be the largest chain drive transmission in the world is installed in the Ox-Bow hydro-electric plant at Copperfield, Ore.. The plant consists of one 3,600 k.w., 3-phase, 60-cycle generator, running at 225 revolutions per minute, operated by two water-wheel units. Each water-wheel unit is connected to the generator by four Morse chains 21 in. wide, with sprockets of 2 in. pitch on the line shafting, and with shaft centres 10 ft. apart.

THE PERISCOPE ON MODERN SUBMARINES.

THE submarine is perhaps the most complicated type of war vessel that exists, depending, as it does, upon the complete success of quite a large number of instruments and machines. Not the least important of these is the means by which those in control of the vessel are able to see practically all that goes on at the surface when the boat itself is submerged. The periscope in principle is not particularly complex, since it will readily be seen that it only needs a proper arrangement of mirrors in order that a fairly successful means of seeing objects on the surface of the water should be provided. Yet there are many difficulties in the way of the construction of a really good periscope, for the conditions under which it has to work are not the most favorable for optical success.

The Periscope in Service.

In the first place, the boat has to be completely submerged, and the top of the periscope containing the top lenses and mirrors must, of course, be slightly above the surface of the water. This is a necessarily long instrument, relative to the diameter, and the total length of the tubular part is usually in the neighborhood of 15 to 17 feet. It is very desirable, for objects to be clearly seen by the observer, that the diameter of the tube should not be large, and, externally, it is commonly from 3 ins. to 6 ins. in diameter.

As may be imagined, a tube of this length and such a small diameter is weak, and when it is considered that the boat may be travelling under water at a speed of about 12 knots the pressure of the water naturally tends to prevent the satisfactory operation of the periscope, owing to the possibility of the tubular part of the periscope binding in the stuffing box, in which it slides, this stuffing box being provided to avoid water entering into the submarine. Further complications are introduced by the necessity of the observer to estimate the distance of the object from the submarine, and there are various other factors that have to be provided for, as mentioned later.

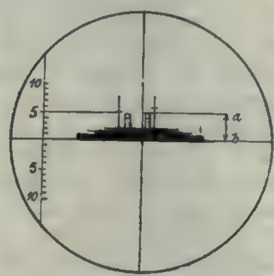


FIG. 2. A BATTLESHIP AS VIEWED BY THE OBSERVER THROUGH THE PERISCOPE IN A SUBMARINE, SHOWING MARKS FROM WHICH THE DISTANCE CAN BE JUDGED.

FIG. 1. SECTION THROUGH AN ORDINARY TYPE OF PERISCOPE AS USED ON MODERN SUBMARINES.

Principle of the Periscope.

The principle of the periscope can be followed from Fig. 1. There is a prismatic lens at the top through which the rays of light enter. These are reflected downwards through various magnifying lenses in the body of the tube, and again horizontally by means of another prismatic lens at the bottom; thence they pass through the eye-piece to the eye of the observer. These lenses in the body of the tube are magnifying lenses, and the degree of magnification is usually about five or six times actual size. It is found that with this increase it is possible for the observer to pick out individual details of the vessel, this being a desirable feature.

It is obvious, then, that at any one moment the section of the horizon that can be viewed through the periscope is limited, and arrangements have, therefore, to be made in order that the periscope tube may be turned so as to compass the horizon as far as possible. It is undesirable that this turning movement should be employed too much, and it is not uncommon in more modern submarines to have two periscopes, one of which always sights right forward. It can be seen that this is particularly ne-

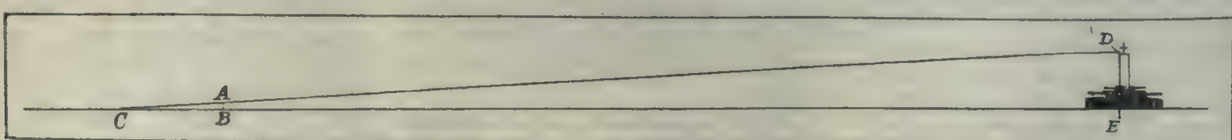


FIG. 3. SKETCH ILLUSTRATING PRINCIPLE OF FINDING THE DISTANCE OF A TARGET FROM THE SUBMARINE.

cessary in the newer boats, owing to the fact that they discharge torpedoes not only forward, but also aft.

Periscope Turning Movement.

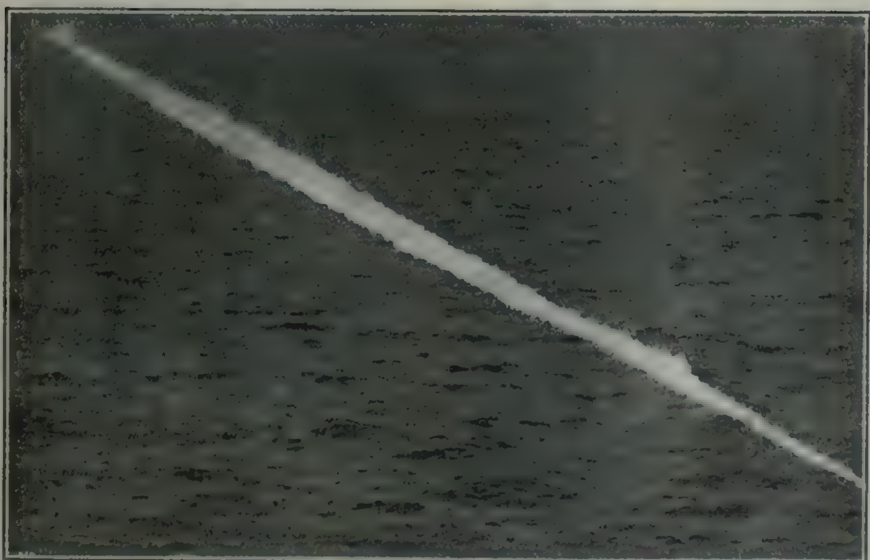
The turning movement of the periscope tube is carried out by means of a hand wheel, which the observer can, of course, operate without taking his eye from the eye-piece. Beyond this, provision has to be made in most submarines for raising and lowering the periscope tube with the stuffing box or gland, and it can well be understood that this may become quite a laborious business when the tube has to be extended nearly to its full range. If the submarine is in action, and awaiting its opportunity to torpedo any hostile vessel, the receiving prismatic lens has to be just above the level of the surface of the water. It may, of course, be considerably higher than this, but the greater length out of the water the more danger does the submarine run of having its periscope broken or damaged, when it becomes quite helpless under water.

In order to avoid the necessity of the observer moving the periscope by hand a small motor-driven winch is now usually fitted, although in some cases the motor is operated by compressed air or hydraulically. There is another interesting and perhaps somewhat unexpected appliance used in connection with the periscope, this being an exhauster arrangement consisting of a small electric-driven motor pump, by means of which the air in the periscope tube can be exhausted, passed through a drying medium, such as calcium chloride, and returned again to the periscope. This is necessary, as there is a natural tendency for the air in the periscope tube to become permeated with moisture, the disadvantages of which may hardly be explained.

Ascertaining Line of Direction.

Another device that is necessary with the periscope is a means of ascertaining the line of direction of the view, without which it is impossible to tell exactly the course which will be taken by the torpedo when discharged. There is nothing difficult in arranging a gauge for this purpose, and in early submarines this was external to the periscope, so that the observer had to take his eye from the point of observation and note the bearing of the submarine on an instrument outside the periscope. This meant the readjustment of the focus of the observer's eye, with a consequent loss of valuable time, and the arrangement now adopted is to embody the indicator within the periscope itself, so that this is always in view of the man looking through the eye-piece.

VIEW OF SUBMARINE FULLY SUBMERGED, RUNNING AT 10 KNOTS AND SHOWING TWO PERISCOPES. Cut, Courtesy of "Syren and Shipping."



WAKE OF A TORPEDO FIRED FROM A SUBMERGED SUBMARINE. Cut, Courtesy of "Syren and Shipping."

Finding the Range.

Although there is not the same importance in a submarine of knowing the distance of the target as in a larger war vessel, it is very desirable that the range should be known within a reasonable degree of accuracy. The rough principle for finding the range is illustrated in Figs. 2 and 3, although these do not in any detail represent actual measurements to scale, but are purely diagrammatic. In Fig. 3, B represents the position of the observer's eye, and it is taken for purposes of simplicity that he views the ship in the distance directly and not through the system of magnifying and prismatic lenses which actually constitute the periscope. Through the periscope he sees the height of the ship from the water-line to the top of the funnel represented by a distance ab (Fig. 2). If DE is the height of the funnel, then $\frac{AB}{BC} = \frac{DE}{EC}$. This ratio $\frac{DE}{EC}$ may, therefore, be expressed as a percentage.

This is indicated in Fig. 2, which shows the target as viewed by the observer, where to the left are seen marks indicating the actual percentage. If, therefore, five per cent. is indicated, the height of the top of the funnel of the enemy ship above the water-line is five per cent. of the distance between the ship and the submarine; in other words, the range is 20 times the height of the funnel.

As the height of the funnels of all ships is known fairly accurately, the range can be gauged quite closely enough for all practical purposes. For instance, with a battle cruiser having the top of its funnel 80 feet above the water-line, the range in the case mentioned would be 1,600 feet.

The officer observing through the periscope is, of course, in charge of the whole ship, and has at hand not only the steering wheel, but also the speaking tubes to the engine-room and to the torpedo station.—Motor Ship.

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Vol. XIII. MAY 13, 1915 No. 19

PRINCIPAL CONTENTS.

THE CHALLENGE OF THE LUSITANIA.

THE world's civilization rocks to-day, for while there are but few even among those of tender years who are unaware of the fact that "all that glitters is not gold," still fewer would have been prepared to affirm that Germany's role as a civilized power was but a veneer, and that things were not what they seemed relative to her heart and head. Whether the veneer has worn off, been rubbed off, or has fallen off, is immaterial, she is little abashed about it, even although history—sacred and profane—marks no blacker page than the tragedy of the Lusitania in its challenge to High Heaven.

Widespread, and in large part, silent indignation has been aroused the world over; in some quarters revenge and swift retribution have been demanded, and by still others the incense to war is being pressed with a vigor quite worthy of the abnormal circumstances. Much impatience is naturally being exhibited, and as is usual, even under less trying circumstances, it is in no sense justifiable. Germany in the past nine months has done more self-wrecking than the Allies with a triple backing could have even begun to accomplish and this feature need and should not be lost sight of under her most tantalizing dastardliness.

A rather determined effort is being made by Germany to inflame and involve the United States in the conflict, and, on the other hand, a much too great importance is attached to what might be expected of the active co-operation of that country in helping crush the terrorism. While the attitude of the American Government has not in any particular sense been marked by display of moral courage, its record up till now having been passive indifference on the one side and passive assistance on the other—a naval supremacy contributing, the development of the hour makes imperative on the high grounds of Christianity, humanity and a world freedom from tyranny and frightfulness, that whether passive or active assistance of the Allies be the future policy or not, indifference to its duty and neglect of its national and international obligations must cease.

No matter what the individual constitution of the United States be, the hour of its decision, of its destiny perchance has arrived, and while it need neither be looked upon as the ultimate saviour of the world's freedom by breaking off diplomatic relations with Germany and actively or passively assisting the Allies, accommodating neutrality must disappear.

We are not of those—and they are legion, figuratively speaking, who believe that the United States should be and need be participants in this European conflict. We are, however, of opinion that notwithstanding the Lusitania tragedy, that country has shirked taking the stand that as a Christian nation she has been called upon to take. As already indicated, Germany's retribution may or may not come through American instrumentality, whole or part; it will, however, certainly come, the up-to-the-present attitude of the United States notwithstanding.

The Lusitania will be avenged, and the direction and nature of the blow will neither emanate from Washington, London, Paris or Petrograd, although all or any of these may be the medium. The challenge to Christianity and humanity has been accepted, and will be met successfully. May the United States procrastinate?

EDITORIAL NOTICES.

IN view of the fact that submarine warfare or to be more explicit, Germany's submarine hellishness has been recently brought so vividly and tearfully home to us by the torpedoing of the Cunard liner, Lusitania, we have devoted a section of this issue to a detail description of what might be called the feature equipment—the periscope, of these modern engines of war. Illustrations are also given showing the submarine immersed and the track of the discharged torpedo as visible on the water surface.

In our May 20 issue, the feature article will consist of an illustrated description covering the "Manufacture of Shells and the Brass Cartridge Cases for Same in a Prominent Canadian Railway Shop."

Representative of Canadian manufacturers, their families and administrative staffs who have heeded the call of Empire for active service on our various overseas contingents.

MAJOR J. B. McPHEE,
Barrie Tanning Co., Barrie, Ont.

MAJOR T. C. IRVING,
The Moffat-Irving Co., Toronto.

LIEUT.-COL. E. W. RATHBUN,
The Rathbun Co., Deseronto, Ont.

LIEUT.-COL. J. J. CARRICK,
Pigeon River Lumber Co., Port Arthur, Ont.

CAPTAIN J. T. DUGUID,
Imperial Steel & Wire Co., Collingwood, Ont.

MAJOR W. R. TURNBULL,
The Robt. Duncan Co., Hamilton, Ont.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 00
Copper, crucible	13 00	13 00
Copper, unch-bled, heavy	12 50	12 50
Copper, wire, unch-bled.	12 50	12 50
No. 1 machine compos'n	10 00	10 50
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	10 50	10 50
No. 1 brass turnings	8 00	8 00
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	8 00	8 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect March 19, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	64	47	....	....
½ in.	69	56	....	....
¾ to 1½ in.	74	61	....	....
2 in.	74	61	70	57
2½ to 4 in.	74	61	73	60
4½, 5, 6 in.	....	....	72	59
7, 8, 10 in.	....	....	68	56
X Strong P. E.				
¼, ⅜ in.	57	46	....	....
½ in.	64	53	....	....
¾ to 1½ in.	68	57	....	....
2, 2½, 3 in.	69	58	....	....
2 in.	....	....	64	54
2½ to 4 in.	....	....	67	57
4½, 5, 6 in.	....	....	67	57
7, 8 in.	....	....	60	49
XX Strong P. E.				
½ to 2 in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	58	41	....	....
½ in.	63	50	....	....
¾ to 1½ in.	68	55	....	....
2 in.	68	55	64	51
2½, 3 in.	68	55	67	54
3½, 4 in.	....	....	67	54
4½, 5, 6 in.	....	....	65	52
7, 8 in.	....	....	61	49

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 00	20 75
Castings, copper	19 50	20 50
Tin	48 00	45 00
Spelter	16 00	16 00
Lead	5 60	5 75
Antimony	35 00	40 00
Aluminum	23 50	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in	3.20	....	....	....	....
10 in	3.50	....	....	....	....
10 in	4.12	....	....	....	....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.75
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.73
Linseed oil, raw, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.15½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. (galvanized)	4.60	4.60
Queen's Head, 28 B.W.G.	4.75	4.75
Fleur-de-Lis, 28 B.W.G.	4.45	4.45
Gorbal's Best, No. 28	4.75	4.75
Viking metal, No. 28	4.35	4.35

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 10, 1915.—Industrial conditions remain much as before, there not being much activity along lines outside of that connected with the manufacture of munitions of war. The critical events that are now being enacted in Europe have caused the crushing of all thought of launching new enterprises. However, the normal business of the country is being conducted on the soundest of financial principles.

The steel industry is rather quiet, although from time to time business from foreign countries and the overseas colonies of the Empire keeps cropping up, which shows that our institutions are alive to all opportunities that present themselves.

Machine tools are very quiet, except in lathes and grinders, which are in demand for shell making.

Metals are all going up in price, due to the activities in the war zone and other indefinable causes more or less directly traceable to war influences.

Steel Trade.

Recently the Algoma Steel Co. closed several orders for steel sections to be shipped to South Africa. It appears that this material was purchased f.o.b. steamer at Montreal, the purchaser looking after the freighting of the material. Shortage of tonnage makes ocean freights very high, and, in fact, practically prohibitive, and, were it not for

this serious obstacle, Canada could easily cultivate an extensive business with Australia and South Africa. There is every prospect with the lead now secured and the close of the war that the twenty million tons of steel that Germany exported will be divided among other countries and Canada is bound to receive her share. Steel for shells is more in demand all the time. Tool steel is also selling well.

Pig Iron.

Pig iron continues quiet, and no activity need be expected until the war close.

Machine Tools.

Canada's capacity for forging 18-pdr. shrapnel shells is 23,000 per day, and that for machinery amounts to 40,000 shells per day. The demand for tools, such as lathes, etc., is not, therefore, so great meantime as that for forging presses.

Toronto, Ont., May 11, 1915—There's little change to note in the general industrial situation this week. The weather conditions are satisfactory as far as the crops are concerned, which will help to create a more optimistic spirit in business circles. Prospects at present are very favorable. Although the total volume of business is hardly equal to the output last year, orders for war equipment continue to keep many factories busy. The firms engaged in the manufacture of munitions are increasing in number and the industry is developing in a satisfactory and creditable manner. There appears to be no prospect of relief in regard to the scarcity of ocean tonnage as so many boats have been taken over by the British Government for transport and supply ships. Since the sphere of military operations has extended to the Dardanelles the need for ships for military purposes has become more urgent. The shortage of tonnage will have a tendency to further increase freight rates and also delay shipment of goods.

There are indications of greater activity on the part of municipalities in various parts of the country and a number of civic improvements are being proceeded with. The volume of business, however, that is likely to originate from these sources will be considerably less than in the past few years owing to the financial situation.

Steel Market.

Conditions in the steel trade are showing some improvement but the principal development is in the shell industry. The output of shell forgings is considerably less than the capacity of the machine shops. In order to overcome this deficiency, new presses are being installed in more than one plant, while in addition forgings are being imported from the States. There is a fair demand for structural shapes for bridge work, but the building trade is still quiet. A little better demand for merchant bars is reported but the total tonnage is comparatively light. Prices continue very firm, which is a favorable indication. Galvanized sheets have advanced 15c per cwt., due to the higher prices for spelter which have prevailed for some time, and which show no indication of weakening.

Pig Iron.

The market continues in much the same condition and nothing of interest has developed. Buying is light and prices are unchanged.

BUSINESS DECISIONS.

Business, after all, has some sordid aspects, and all of us at times find it in line with our duty to make decisions which for personal reasons we would rather not make. Everywhere there is stiff competition, a sort of warfare, which has its temptations for the exercise of our most selfish and least admirable traits. Sometimes I think of business as a constant battle between heart influence and head influence. If the heart influence is too much, we may do an injustice to our business and to our stockholders. If the head influence is too much, we may do and injustice to the individual employee, or to our honorable competitors, or to the public. What we must have at all times is a fine mixture of both heart and head influence to the end that we will serve best those whom we work for as well as those who work for us, and those whom we serve, and by whose patronage we exist — the public. — Hugh Chalmers.

Machine Tools.

The shell business continues to monopolize the market and the demand for machine tools is very active. There is no improvement as regards deliveries, which is causing great inconvenience and also creating a good demand for second-hand equipment. There does not appear to be any prospect for a relief in the situation for some time to come, as machine tool builders are filled up with orders. A number of new concerns in the shell business are in the market for tools and their requirements are being met with difficulty. Inquiries for machine tools for 4.5 calibre shells have been received by local machinery houses and it is reported that 60-pounder projectiles will be made in this country.

Supplies.

The supply business has improved considerably and local houses report very satisfactory conditions. The price changes to note are in glue and pure Manila rope. Glue has advanced 3c per pound on account of higher cost of raw materials and in the case of imported English glue, the increase in ocean freight rates. Pure Manila rope has advanced 1c per pound, due partly to a strong market and also to higher cost of raw materials.

Scrap Metals.

Fine business is reported in copper and brass scrap but other lines are quiet. Prices are firmer and crucible copper, brass clippings and brass turnings have all advanced ½c per pound. Scrap zinc is 1c higher and is quoted at 8c per pound. Other prices are given in the selected market quotations.

Metals.

The announcement is made that the Canadian Government has placed an embargo on the export of all metals to all countries with the exception of Great Britain and Allies. This will probably not affect the market to any appreciable extent, as with few exceptions, no large quantities are exported from Canada, and in some cases, are only imported. The general conditions are practically unchanged, the active demand for munitions continues, but business in other respects is quiet. The tin market is weak in New York but stronger in London. Copper is very firm but quotations are unchanged. The antimony and spelter markets continue to advance. Lead is firmer but quiet. The fear of a war between Japan and China has had a tendency to strengthen the London markets.

Tin.—The situation is unchanged and the New York market is irregular with a weak tendency. The London market is stronger but with little enquiry. Tin has declined 3c and is quoted locally at 45c per pound.

Copper.—The market is quiet but firmer, and quotations are unchanged. Production is increasing rapidly but so is the consumption, and will no doubt continue to do so for months. Lake copper is quoted locally at 21c per pound.

Spelter.—The market is firm and advancing. Producers seem to be well sold up and the consumption is increasing, indications pointing to still higher prices. Spelter has advanced 1c and quotations are entirely nominal at 16c per pound.

Lead.—The market is quiet but firm and prices are unchanged. An advance is not at all improbable. Lead is quoted at 5¾c per pound.

Antimony.—The situation is becoming more serious owing to the scarcity of this metal. Supplies are being used almost entirely for munitions. Quotations have advanced 5c and are nominal at 40c per pound.

Aluminum.—The market is steady and quotations are unchanged at 23½c per pound.

OUR MARITIME COAL TRADE.

OPTIMISM prevails in the coal trade of Picton County, and the consensus of opinion among the coal mining men is to the effect that the next four months will see renewed activities in the local coal areas.

The output of the Acadia Coal Co. during the month of April was 22,901 tons, while the sales were 21,107 tons.

The output of the Intercolonial Coal Co. for the same period was 13,207, and while the outputs of both companies are not up to the average, they claim that the coal trade is due for improvement.

The Nova Scotia Steel & Coal Co. will commence shipments to the St. Lawrence at once. Vessels hired are, of course, much smaller than those usually on that route, the half dozen steamers now acting as barriers being small in comparison with those of late years. The six of them will not be able to carry more coal than two of the larger class. The Nova Scotia as well as the Dominion Coal will be hampered as to tonnage for some little time. The Nova Scotia shipments for March were 24,691 tons, as compared with 15,651 for March, 1914, the increase being 9,040. For the three months ending March, the aggregate shipments are 76,182, as compared with 86,391 for the three months of 1914, the decrease being 10.209 tons.

MARCH FIRE RECORD.

THE Canadian fire record for March of this year is not one to be proud of. The year started well, and hopes were entertained that we were going to make a considerable reduction in the fire waste. Compared with February the number of fires is as follows:

	Feb.	March
Fires over $1,000	24	20
Fires $1,000 and under $10,000	79	106
Fires $100 and under $1,000	187	198
Fires under $100	291	364
	581	688

It will be noted that the greatest increase occurred in the smaller losses. The conclusion to be drawn from this is that a large proportion of them were preventable, and were discovered and put out when still in their incipient stages. It is also a regrettable fact that during the month of March twenty-six persons lost their lives through fires.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

St. Catharines, Ont.—Slough & Bush will equip a plant for making shells.

Preston, Ont.—The Dominion Bronze Co. will equip a plant for making shells.

Lindsay, Ont.—The Wilford Machine Co. have secured a contract for shrapnel shells.

Maisonneuve, Que. — The Shawinigan Water & Power Co. will build a repair shop here.

Brantford, Ont.—The Ker & Gordon Co. has been reorganized and will equip a plant for making shells.

Moncton, N.B.—The Record Foundry Co. will make considerable extensions to their plant for making shells.

Truro, N.S.—A H. McLean, of this town, is engaged in organizing a company to manufacture a tree-sawing machine.

Orillia, Ont.—The Canadian Smelting & Refining Co. propose to instal a nickel refining plant here and build a smelting plant at North Bay.

Chatham, Ont.—President L. A. Cornelius announces that the plant of the Canadian Wolverine Brass Co., destroyed by fire on April 10, will be rebuilt.

Winnipeg, Man.—The Ford Motor Co. of Ford, Ont., has purchased a site here and will erect an assembling plant and service station to cost $250,000.

Paris, Ont.—The ground floor of the town hall has been leased by the Council to G. W. McFarlane for the manufacture of shells for the Imperial Government.

Weyburn, Sask.—The town council contemplate buying a booster pump for the fire department, to cost $4,600. The installation of a fire alarm system is also under consideration.

Sackville, N.S.—The Fawcett Manufacturing Co. has secured a large contract for high explosive lyddite shells, and will begin manufacture in about a month. The shells are for the British Government.

Peterborough, Ont. — Wm. Kennedy, Jun., consulting engineer, Montreal, has been retained by the city to prepare plans for an auxiliary pumping plant, with a capacity of 4,000,000 gallons per day.

Kingston, Ont.—It is announced that the Canadian Locomotive Co. of this city has received a large order from the British Government for the manufacture of a large type of shell.

New Glasgow, N.S.—It is officially announced that the Nova Scotia Steel Co. has received new shell orders aggregating in value $3,600,000, while the company's subsidiary, the Eastern Car Co., has finally closed the order for 2,000 steel frame box cars, which has been under negotiation for some time.

General Industrial

Galt, Ont.—P. Fitch and J. McCormack, of this town, propose to establish a silk factory here.

Vancouver, B.C.—The Barnett & McQueen Co. will begin shortly the construction of the new Government elevator.

Lethbridge, Alta.—The Taylor elevator at Vulcan has been purchased by A. Lee, who proposes to erect another with a capacity of 30,000 bushels.

Chatham, Ont.—It is announced that the Dominion Canners, Ltd., will build a factory here. It is expected that the factory will be erected this year.

Sault Ste. Marie, Ont.—The Standard Chemical Co. has commenced the erection of a large extension to its plant here and about $100,000 will be spent on the work.

The B. F. Sturtevant Co. of Canada, Montreal, has received the contract from the Sherbrooke Protestant School Board for the installation of a ventilating system at the high school.

Preston, Ont.—The industrial by-law voted on May 3rd to grant aid amounting to $21,500 to a company which will occupy the Anchor Bedding factory, was carried by a narrow majority.

Vancouver, B.C.—The Gosse-Millard Packing Co. has completed the purchase of the salmon cannery at Bella Bella, about 300 miles from this city, on the western coast of the mainland.

Walkerton, Ont.—W. G. Searle, formerly of the firm of Pletsch & Searle, proprietors of the Walkerton Flour Mills, has taken over the business of the Peerless Milling Co., on Dufferin street, Toronto.

Municipal

Tilbury, Ont.—A new fire station will be erected here to cost $8,000.

Windsor, Ont.—The city will buy motor driven fire trucks.

Ford, Ont.—The town council contemplate buying a quantity of 8 in. cast iron pipe.

Mount Dennis, Ont.—The installation of a waterworks system is under consideration.

Port Colborne, Ont.—The town council may purchase 4-in. and 6-in. pipe for water mains.

Cranbrook, B.C.—The city is in the market for a quantity of 4-in. steel pipe and fire hydrants.

Redcliffe, Alta.—The fire committee has recommended the purchase of a motor fire-truck.

Preston, Ont.—The Board of Trade is negotiating with a company who propose to locate here.

Blenheim, Ont.—The Hydro proposition by-law was carried here on Monday by a majority of 236.

Ottawa, Ont.—The city will buy a number of water meters and has appropriated $2,500 for this purpose.

Bracebridge, Ont. — Extensions are contemplated to the waterworks system to cost $12,000. The by-law has been passed.

Regina, Sask.—The city has appropriated $121,000 for sewage disposal improvements, waterworks and power distribution extensions.

Thamesville, Ont.—The Hydro-Electric by-law carried here last Monday almost unanimously. The figures are 124 for the by-law and 2 against.

Swift Current, Sask.—A by-law will be voted on to raise $15,000 for the construction of an incinerator. The Reid Incinerator Co., of Toronto, will probably erect the plant.

Hamilton, Ont.—The town of Burlington has made application before the Provincial Board of Health with reference to the provision of a sewage disposal plant in the township of Nelson. The work will involve an immediate outlay of $14,000, and a total expenditure of $150,000.

Ridgetown, Ont.—The ratepayers carried the Hydro by-law on Monday by a vote of 254 to 38. The 'y-law to change the present system and instal Hydro was carried by 223 majority.

Chesley, Ont.—It is expected that a by-law will be submitted inside of a month to enable the town to contract for a supply of hydro power. The plan is to extend the Eugenia Falls-Owen Sound line as far as Chesley, and supply this town and intermediate points with power developed at Eugenia.

Hamilton, Ont.—Tenders for motors for the disposal plant at Gage Avenue have been opened. The tender of the Swedish Electric Co., which was $2,750, was the lowest, and the Canadian Westinghouse Co. tender of $3,325 the next lowest. The city engineer recommended the Westinghouse tender, as there was doubt as to delivery from Sweden.

Stratford, Ont.—Second reading was given by the city council on May 5 to two by-laws, one providing for a $2,500 site grant to the Bartlett Automobile Co. of Toronto for the establishment of a factory here, and the second providing $7,000 to retire the General Hospital floating debt. In the Bartlett measure a minimum wage stipulation of eighteen cents per hour was agreed to by the company, constituting a precedent for industrial by-laws here. May 31 was set as the date for voting on both by-laws.

Tenders

Brockville, Ont—Tenders will be received up to May 17 for the construction of a mechanical filtration plant. Plans and specifications may be seen at the office of G. H. Bryson, Town Engineer.

Orillia, Ont.—Tenders will be received until May 17, for centrifugal pumps and motors, cast iron pipe and a Venturi meter. Specifications at the office of F. Gover, sec'y-treas., Water, Light and Power Commission, Orillia.

Transcona, Man.—Tenders will be received up to May 15 for the supply and erection of pumps and motors, etc. Plans and specifications may be obtained from W. M. Scott, engineer, 204 Sterling Bank Building, Winnipeg, Man.

Ottawa, Ont.—Tenders will be received until Thursday, May 20, 1915, for dredging required at Toronto, Eastern Gap. Combined specifications and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa.

Toronto, Ont.—New tenders will be received until Friday, May 14, 1915, for Administration Building, College Street. Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto.

Contracts Awarded

Brantford, Ont.—Schultz Bros. Co. have been awarded the contract for the new power station.

The Kerr Engine Co., Walkerville, Ont., has been awarded a contract for hydrants by the town of Parry Sound, Ont.

Hamilton, Ont.—The Board of Control has awarded the general contract for the new hospital to James Frid & Co., at $90,529.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British.—Lieut. Johnston and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

London, Ont.—The contract for the new grand stand at Queen's Park has been awarded to the McGregor, McIntyre Co., of Toronto, for $29,500.

Ottawa, Ont.—Thomas Lawson & Sons received the contract for pipe for the four low-lift pumps at Lemieux Island at $1,777.

Wallaceburg, Ont.—At a special meeting of the Board of School Trustees, the contract was awarded to W. G. Shaw of Sarnia for the erection of the new school, at the bulk price of $20,885.

Building Notes

Calgary, Alta.—Plans are being prepared for an addition to the Collegiate Institute to cost $200,000. The Building Commissioner has the matter in hand.

Refrigeration

Calgary, Alta.—A company is now being organized to operate a large abattoir and packing plant here. The plant itself is estimated to cost $600,000.

Montreal, Que.—The Standard Chemical Co. has had installed by the Linde-Canadian Refrigeration Co. a 25-ton refrigerating and water cooling plant.

Estevan, Sask.—Alfred Harris, of the Clarendon Hotel, is organizing a company to establish a pork packing plant here. The cost is estimated at $17,000.

Toronto, Ont.—John Klees has had his storage rooms equipped with a 5-ton refrigerating plant furnished by the Linde-Canadian Refrigeration Co., Montreal.

Morrisburg, Ont. — The Morrisburg Poultry Co. have had their poultry, butter and egg storage rooms equipped with a 25-ton refrigerating plant by the Linde-Canadian Refrigeration Co., Montreal, P.Q.

Montreal, Que.—William Davies, Ltd., packers, have had a complete 50-ton air cooler installed, contract for which including pumps, fans, spray system, air ducts, etc., was let to the Linde-Canadian Refrigeration Co.

Windsor, Ont.—William J. Pulling, of this town, has purchased the artificial ice manufacturing plant of the Central Ice Co., of this city. The price paid is stated as $43,000 in cash. The plant, which was built only last year, cost in the neighborhood of $85,000.

Marine

Port Stanley, Ont.—The steamer J. Frater Taylor is now awaiting survey in the Western Dry Dock.

Toronto, Ont.—It is announced that the Toronto Harbor Commission will spend $2,000,000 this season on improvements. A large part of this money will be spent on the Ashbridge's Bay section.

Sault Ste. Marie, Ont.—Because of low water on the Great Lakes many vessels are forced to sail with 400 and 500 tons less than they would ordinarily carry if the water were normal. The recommended draught at the "Soo" for boats loading for Lake Michigan has been cut down six inches. All masters of the Pittsburg fleet have been notified not to load deeper than 19 feet 3 in. when taking cargoes from the head of the lakes for Lake Michigan. Many carriers trading to Lake Erie ports are now loading to 18 feet 9 in. only.

New Incorporations

Canada Ingot Iron Co. has been incorporated at Ottawa with a capital of $20,000 to manufacture steel culverts, pipe, sheets, etc., at Guelph, Ont. Incorporators: Henry B. Sharman, Robert William Gladstone, of Guelph.

The Standard Primer & Fuse Co. has been incorporated at Ottawa with a capital of $150,000 to manufacture time and percussion fuses, detonators, etc., at Toronto, Ont. Incorporators: Thomas A. Rowan, Norman Somerville and Harry A. Newman, all of Toronto.

Wood-Working

Niagara Falls, Ont.—Fire did $25,000 damage to the Richard Smith and Sons' lumber mill here on May 9.

Pembroke, Ont.—Fire on May 4 damaged the Pembroke Lumber Co.'s sash and door factory to the extent of $75,000, which is fairly well covered by insurance.

Railways—Bridges

Walkerton, Ont.—A new bridge will be erected here at a cost of about $2,000.

Palmerston, Ont—A hydro-electric line is proposed to connect Milverton, Listowel, Palmerston, Harriston and Clifford.

Brantford, Ont.—The Lake Erie & Northern Railway propose to connect with the Galt, Preston & Hespeler line at Galt, and electrify the road through to Port Dover.

Brantford, Ont.—Work on the Lake Erie & Northern Railway south of Brantford, on the line to Port Dover, is being rushed. Track laying has started at Simcoe and Mount Pleasant.

Personal

Lieut. H. F. H. Hertzberg of the 2nd company of Canadian Engineers, has been wounded in Northern France.

Dr. F. S. Pearson, a well-known figure in Canadian financial circles, was drowned by the sinking of the Lusitania.

James Barr, B.Sc., assistant engineer of the Waterworks Department, Toronto, lost his life when the R.M.S. Lusitania foundered.

Lieut. Henry Aubrey Thompson, of Mitchell, Ont., and engineer in the Department of Public Works, Chase, B.C., has been wounded at the front.

T. J. Scott, Canadian Locks, Sault Ste. Marie, Ont., is now equipped to undertake repairs necessitating the application of the electric welding process.

F. L. Wanklyn, assistant to the president, C. P. R., at Montreal, has been appointed honorary lieutenant-colonel of the Canadian Overseas Railway Construction Corps.

George E. Francklyn, agent for Lloyd's underwriters, died at Halifax, N.S., on May 2. Mr. Francklyn, who was 67 years old, was a grandson of Samuel Cunard, founder of the Cunard Line.

J. A. Farrel, president of the United States Steel Corporation, was in Winnipeg, Man., recently. He is on a pleasure tour of Western Canada, prior to visiting the Panama-Pacific Exposition at San Francisco.

John Goodison, president of the John Goodison Thresher Works, died on May 7 at Sarnia, Ont. Mr. Goodison was born in Ireland in 1850 and came to Canada 8 years later. He founded the company bearing his name in 1892.

M. J. Gorman, mechanical superintendent of the National Steel Car Co., Hamilton, Ont., who is leaving the company, was on May 1 presented with a diamond ring by the foremen and assistants as a token of esteem. The presentation was made by Cecil R. Keniston.

John Morris, chief engineer of the Newmarket waterworks and electric light system, has resigned his position and leaves for a northern town. He will be succeeded by William O'Halloran, who for more than 12 years occupied the position previous to Mr. Morris.

J. G. G. Kerry, of the firm of Smith, Kerry & Chase, Toronto, was in Hamilton recently for the purpose of examining the new east end main and pumping station. Mr. Kerry will also report on the advisability of the city building a large reservoir and also on a system to keep down heavy Hydro bills.

J. K. McNeillie, C.P.R. superintendent of district No. 3, has been appointed general superintendent of the Intercolonial Railway, and has left Montreal to assume his new duties at Moncton, N.B. Mr. McNeillie joined the C. P. R. in 1896 as a clerk at Farnham, and has been in important positions on the C. P. R. at Winnipeg, Toronto and Montreal.

F. P. Brady, who has been general superintendent of the I. C. R. at Moncton for the past eight or ten years, has been appointed general manager of the National Transcontinental Railway, between Quebec and Winnipeg, and the Lake Superior branch of the Grand Trunk Pacific Railway between Fort William and Superior Junction, with headquarters at Cochrane, Ont.

Trade Gossip

The Gartshore-Thompson Pipe & Foundry Co. have received the contract for 1,400 feet of cast iron pipe from the city of Hamilton, Ont.

C. M. A. Annual Convention.—The Annual Convention of the Canadian Manufacturers' Association will be held in Toronto, from Tuesday, June 8, until Thursday, June 10, inclusive.

St. Thomas, Ont.—The Noble Manufacturing Co. biscuit and candy factory, which has practically been closed for the past few months, is reopening at once, with S. Herbert Moore, late of Toronto, as general manager. The company has been completely reorganized, with George M. Baldwin, president, and J. Dowler, vice-president.

Russian Shell Commission.—Several members of the Shell Commission, appointed by the Russian Government to visit this country and the United States, and especially the centres where the heavy orders are being filled, have arrived in Canada. A general of the Russian Army is chairman of the commission, and that officer will reach here a little later on. The party is composed of Capt. W. Wexkrassoff, Capt. Oranowsky, Capt. Grodski, and Messrs. Adrinoff and Sokoloff.

The Lauzon Engineering Co., Ltd., Levis, P.Q., have bought the large factory building, together with the machinery therein, formerly occupied by the General and Shoe Machinery Co. of Levis. The building and equipment have been thoroughly overhauled and about $50,000 worth of new machinery installed. It is intended to go into the manufacture of shrapnel shells in a large way. In addition to the manufacture of shells, the above company intend doing marine and general mechanical work. Harry Paquette will be the general manager, and J. H. Fontaine, mechanical superintendent.

Canadian Locomotive Co. Extensions.—In view of the additional shell orders that have been secured by the Canadian Locomotive Company, Kingston, Ontario, according to a statement by A. W. Wheatley, vice-president and general manager, it has been found necessary to proceed with additions to the plant. The new extensions will be utilized for the manufacture of 4.5 and 60-pounder shells. The new shop, which is to be 233 feet long by 67 feet wide, will, it is expected, be ready for occupation within six weeks. The com-

pany has 400 employees at present on its books, and, with new orders pending, this number should be almost doubled.

High-speed Steel Boom.—There is no abatement in the demand for high-speed steel. Every available furnace in Great Britain for which men can be found, is working on this material, and any maker, however little known, can pick up more orders than he wants. The occupation of the traveller has gone for the present, as there is no need to solicit business. On the contrary, consumers of steel are begging to be supplied. The demand for alloys of steel far and away exceeds anything previously known, and the utmost difficulty is experienced in meeting it, especially when the material has to be imported. English makers are working day and night. Steel makers are still awaiting the tungsten powder to be produced in this country.

Scarcity of Tonnage.—The opening of St. Lawrence navigation brings no promise of relief in regard to the scarcity of ocean tonnage. All the larger and faster ships formerly in the Canadian service are still in use by the Admiralty and there is no prospect of their being released, especially in view of the recent increase in the sphere of British military operations. The presence of large armies in Europe, in Egypt and in the Gallipoli Peninsula, calls for a large fleet of transport and supply ships, and there is no expectation that any of these ships will be released by the Admiralty during the present season. At the same time it is expected that a reasonably good mail service will be maintained, perhaps as good as the old service, though not equal to the improved fast and frequent service which was in operation prior to the outbreak of war.

Catalogues

Oil Strainers.—A new bulletin published by the Elliott Co., Pittsburg, Pa., is devoted to a description of their twin oil strainers. Several views are shown of this apparatus with a table of dimensions.

A Manufacturing Power Press is the title of a bulletin issued by the Rockford Iron Works, Rockford, Ill. The bulletin illustrates various types of Rockford high-duty punch presses and gives a specification comprising the principal dimensions for each size.

Test Indicators.—The C. E. Robinson Co., Orange, Mass., has issued a bulletin describing their improved test indicator designed to record the minutest variations possible and at the same time to be capable of limitless adjustments to any class of mechanical work. The indicator and attachments are fully described and a series of illustrations show some classes of work for which it is specially suitable.

A Safety Code for the use and care of abrasive wheels has been compiled by the Safety Committee of the abrasive wheel manufacturers of Canada and the United States. The code is to be used as the foundation of a campaign for uniform laws and insurance rules in an endeavor to overcome present and prevent future unsafe practices. The whole subject of grinding has been carefully covered and many valuable suggestions are included. Copies of the code may be obtained from the Canadian Hart Wheels, Ltd., Hamilton, Ont.

Cableways on Filtration Work are clearly described in bulletin No. 32 being distributed by Canadian Allis-Chalmers, Ltd., Toronto, exclusive agents for Canada for the Lidgerwood Manufacturing Co., New York. The bulletin contains some interesting particulars of installations of Lidgerwood travelling cableways used in the construction of water filtration plants. Views of the work are included, showing the advantages to be obtained by using cableways and the general utility of this system of transporting materials.

Bruce Peebles & Co., Edinburgh, Scotland, have recently published a new booklet No. 706B, entitled Peebles' Works and Manufactures. The booklet is divided into two distinct parts, the first giving a detailed description of the company's works and development of the business from the time of its inception. The illustrations show interior views of the various shops referred to in the text. The second part consists of a number of half-tones of different types of electrical machinery made at the company's works, accompanied by a brief description of each machine.

Grinding Wheels.—The Canadian Hart Wheels, Ltd., Hamilton, Ont., have issued a standard grinding wheel price list which will be effective on July 1, 1915. This new list does not attempt to fix new prices, but simply introduces a method of ascertaining consistent list prices. When the present list is withdrawn, new discounts will be issued, where necessary, to apply to the new list adopted by the leading manufacturers of grinding wheels in Canada and the United States. The new lists have been adopted in order to correct the inconsistencies in the present standard lists in relation to the value of different size wheels to each, and in their relation to the cost of manufacture. Users of grinding wheels may obtain copies on application to the above.

Testing V-Notch Meters, issued by the Harrison Safety Boiler Works, Philadelphia, Pa., is a reprint of two important papers on the V-notch weir as used in the Cochrane Metering Heaters. The earlier paper, by James Barr, describes at considerable length and detail the apparatus used by him, and the results obtained in tests conducted at Glasgow University in 1907-09, by which he established the fact that with a V-notch weir, the true discharge for given conditions could be determined within 1-3 of 1 per cent. The latter paper, by W. S. Giele, describes a commercial testing apparatus of large capacity installed by the Harrison Safety Boiler Works for the purpose of carrying out an extensive series of tests upon V-notch weirs of different dimensions and as actually installed in commercial meter chambers manufactured by them. Both papers are interesting as illustrating on the one hand the many refinements which are essential in the precise investigation of problems in hydraulics, and, on the other, the admirable constancy of the V-notch weir when used under known and pre-determined conditions.

Book Reviews

Boiler Management and Inspection, published by the Joseph G. Branch Publishing Co., Chicago, Ill., is listed at $1 post paid, and not 50c as stated in the review published recently in Canadian Machinery.

Effect of Boron Upon the Magnetic and Other Properties of Electrolytic Iron Melted in Vacuo, by Trygve D. Yensen, has just been issued as Bulletin No. 77 of the Engineering Experimental Station of the University of Illinois. This bulletin is the second of a series dealing with the magnetic, electrical, mechanical, chemical, and metallurgical properties of iron melted in a vacuum furnace. It was shown in Bulletin No. 72, "Magnetic and Other Properties of Electrolytic Iron Melted in Vacuo," that iron of an exceptionally good magnetic quality could be produced in such a furnace. Bulletin No. 77 gives the results obtained by adding boron to pure iron. Small percentages of boron added are shown to improve the iron slightly, while boron added in a sufficient amount to leave a measurable quantity combined with the iron has a decidedly detrimental effect upon the magnetic properties. The crystalline structure of the alloys is shown by means of numerous photographs. Copies of Bulletin No. 77 may be obtained gratis upon application to C. R. Richards, Acting Director, Engineering Experiment Station, University of Illinois, Urbana, Illinois.

ANTI AIR-CRAFT GUNS.

DURING recent years, much time and money has been expended on the perfection of guns giving high-angle fire for the destruction of aircraft. A great measure of success has already been attained in the solution of this problem, which literally bristles with difficulties, first among which is that of hitting any rapidly moving and inconspicuous object at great ranges. In the case of aircraft, difficulties are further increased by the fact that there are no landmarks in the zone of fire, to facilitate range finding. Events in the present war indicate that aeroplanes are best attacked by other and faster planes, and there can be no doubt that aeroplanes would be very valuable in attacking airships. At the same time, the size of the latter marks them down as objects on which artillery fire could usefully be directed.

The exact value of the anti-aircraft gun has yet to be demonstrated, or perhaps we should say published. Its object is definite, viz., to wreck aeroplanes or airships. Mere explosion of shrapnel in the neighborhood of an aeroplane is not sufficient to ensure its destruction; modern machines have remarkable stability, and nothing much less than mortal injury to the engine or pilot is effective. Rifle fire from another aeroplane seems to afford quickest and most effective defence. The vital part of an airship is its gas envelope. It is the largest target, and if it be damaged badly the fate of the craft is sealed. Cellular construction renders local damage or mere penetration of minor importance.

What is required is explosion of an incendiary shell on or within the envelope with consequent ignition of the gas. Flat trajectory increases the chance of a hit even when the range is inaccurately estimated, and a smoke trail permits the path of the shell to be traced and the fire to be regulated in accordance therewith. Specially delicate percussion, trigger, chemical and electric fuses have been devised in order that the slight resistance offered by the envelope may suffice to explode the shell. Trials have been made with special claws on the projectile, the aim being to rend the envelope, but wholesale explosion would seem more practicable and certainly more effective.

Most of the great arsenals have turned out 6, 9, 12 or 14 pounder anti-aircraft guns for field use, and heavier weapons up to 40-pounders for stationary mounting. Elevation up to 75 degrees in any direction is arranged, and a maximum height of 20,000 feet or so is reached by the shell. Obviously no ordinary field gun is capable of meeting these requirements, and howitzers give insufficient accuracy of fire. Only a high velocity, high angle gun can be effective.

The man in the street is considerably concerned to know what happens to the shells after they have hit or missed the hostile aircraft. Naturally they come down again, and when a crowded city is being defended inhabitants would be well advised to obey the official advice to keep indoors. From the military standpoint, however, the falling shells are of no importance. The object is to bring down some hundredweights or some tons of aircraft presumably much nearer the defender's forces than the relatively insignificant shells will fall.

POWDER AND SHOT.

IN the British House of Commons recently, Mr. Lloyd George announced that at the present time, by methods of sub-contracts, between 2,500 and 3,000 firms were employed in the manufacture of munitions of war; and gave an interesting indication as to how the output has proceeded. In September there was a considerable increase over August, and there was an increase in August over July, but he took September as his basis.

Taking 20 as representing the output in September, by October it went up to 90, and in November it was 90 again. Of course the new machinery laid down did not come into operation until a month later. In December it was up to 156, January 186, February 256, and March 388.

This means that even the increased output in September was in March multiplied nineteen-fold, and the Chancellor had no hesitation in saying that in April the increase would correspond to that which had taken place in the previous months. Nor is this the whole of the Allies' advantage, for, according to Bonar Law's information, while we have multiplied our munition output by 19, France has increased hers by 30 fold.

Electric Hoist at Mountain Park Railway, Hamilton, Ont.

The accompanying illustrated descriptive article features a species of power plant equipment well removed from the beaten path of either hydro-electric or steam power generation. In its essence and service, the installation relates more especially to power transmission and application achievement of a rather uncommon nature, yet dealing with a valuable and highly appreciated means of transportation peculiarly local in its purpose and demand.

THE Hamilton Mountain Park Co., Ltd., of Hamilton, Ont., recently installed a new electric hoist, with interesting and novel features, to operate their incline railway which gives access to the large tract of land they have acquired at the top of the mountain and to the fertile country beyond. The "Mountain," as it is called, is really the Niagara escarpment, the steep bluffs behind Hamilton being a prolongation of the heights at Queenston, over which the Niagara River originally flowed, before cutting back the gorge to the present falls. The difference in elevation between the general level of the city and the plateau back of the bluffs is 325 feet, and as the roads leading up the bluffs are few and necessarily steep, the incline in question does a very large business in transporting passengers, automobiles, teams, etc.

The original steam hoist used for this purpose became utterly inadequate to handle safely and quickly the rapidly increasing traffic. The present installation is modern in every detail and is equipped with numerous automatic safety devices which, so far as is humanly practicable, will prevent any possibility of accident. The contract for the complete equipment was taken by the Canadian General Electric Co., Toronto, Ont.

Hoist Type and Capacity.

A special double fixed drum, double geared electric incline hoist built by the Lidgerwood Co. of New York, and represented in Canada by Canadian Allis-Chalmers, Limited, operate two cars in balance on an incline of 800 feet long, with a grade of 40.27 per cent. Each car weighs 30,000 lbs., and runs on tracks having a gauge of 12 ft. 1½ ins., the centre to centre of tracks being 20 ft. 3 in. The average load on the cars will be about 20,000 lbs., with a maximum load of 30,000 lbs., and the hoist arrangement is suitable for either hoisting the maximum load with empty car descending, or for lowering the maximum load with the empty car ascending.

The time required for making a single trip is 1½ minutes, and the rest period between trips will be 3 minutes. Attached to each car are two ropes of 1⅝ in. diameter, each rope weighing 4.15 lb. per ft. One of these ropes is used for hauling the car, and the other for the purpose of safety. The average rope speed during the run is 585 feet per minute.

Incline Arrangement.

The hoist is located in a house 106 ft. from the knuckle between the incline and the level of the summit, and the main rope from the right hand car is wound over the top of the right-hand hoist drum, while the main rope from the left-hand car is wound underneath the left-hand hoist drum. The safety rope from the right-hand car is led over suitable deflecting sheaves to the top of the left-hand drum, and the safety rope from the left-hand car is wound over suitable deflecting sheaves to the bottom of the right-hand drum. Each of these sheaves is 7 ft. in diameter to the bottom of the rope groove, and weighs 3,500 lb. There are 4 head sheaves and 4 deflecting sheaves, making 8 in all.

The head sheaves are arranged vertically so as to carry the hoist ropes and safety ropes in a direct line from the

MOUNTAIN PARK RAILWAY, HAMILTON, ONT.—VIEW FROM MOUNTAIN TOP.

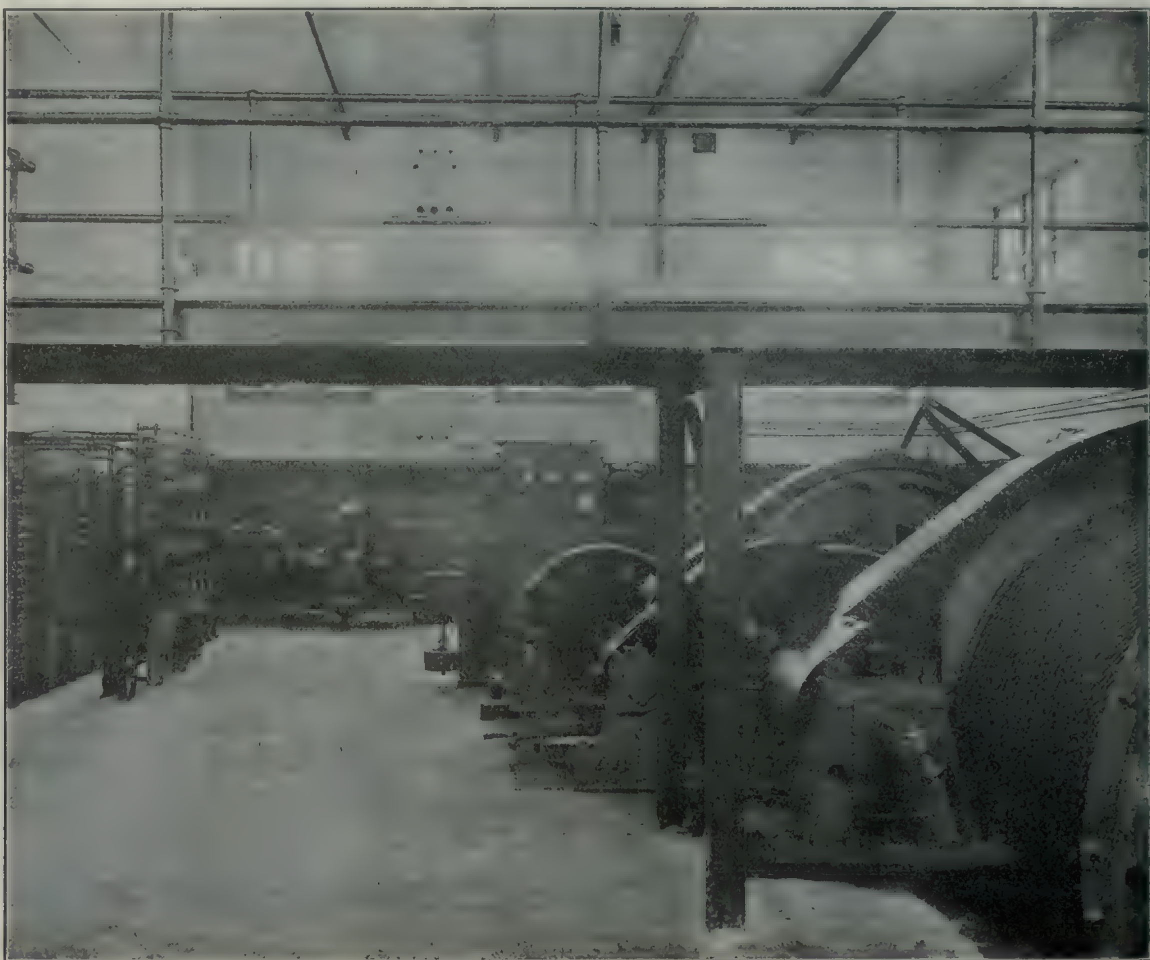
cars, while the deflecting sheaves are placed horizontally at such an angle that the rope will be led in a direct line to either the top or bottom of the hoist drums, as the case may be. Floating sheaves are also furnished to guide the ropes and are placed in the rope tunnels between the head sheaves and the hoist drums. The reason for reeving the safety ropes as outlined above is that, in case of an accident to the left-hand side of the hoist, the safety rope on the left-hand car would take care of it properly, being on the right-hand drum; the same thing would apply if the other drum of the hoist should become disabled; that is, the main ropes and the safety ropes from each car lead to opposite drums.

Further advantage is gained by the fact that each drum is equipped with an independent double-acting brake, and in case either of the main ropes should break, the safety rope will hold the cars. Again, the safety rope if called upon to take the load, will be controlled by all the automatic brake features in exactly the same manner as when the load is being handled by the main ropes. In actual operation, the length of the safety ropes will be slightly more than that of the main hoist ropes, thereby relieving the safety ropes of any hoist stresses other than those required to keep the ropes themselves in motion.

Operation and Safety Appliances.

The operator's cabin is fitted with one electric control and two hand brake levers, but the levers will not be used ordinarily, as the hoist is equipped with solenoid brakes operating on the motor shaft. The hand brakes, therefore, need only be used for the locking of the cars at the top and bottom positions, or for cases of emergency. In starting a run, the operator releases the drum post brakes by the hand levers, puts his foot on the small foot pedal located at bottom of master controller and by moving the handle of the controller to either the right or the left, as the case may be, the cars will start and will automatically accelerate to the normal rope speed. At a predetermined point on the incline, the controller handle will be automatically turned to such a position that the speed will be cut down to 1-10 of the normal, and finally be turned to the off position, thus setting the solenoid brakes and bringing the cars to rest. Should the operator become disabled during a run, he will of necessity remove his foot from the foot pedal, thereby cutting off the current, bringing the cars to rest. In order for the cars to move, the operator's foot must be on this pedal.

In case the cars should stop short of their landing position, due to the automatic over-winding mechanism, there are available two or three points on the controller, so that the operator can bring same to their proper positions, and should the cars fail to stop due to the fault of controller, an over-winding device is attached which will shut off the current and set the solenoid brakes. Should the speed of the cars exceed the normal by a predetermined amount, an over-speeding device is so arranged that it will trip a weight of 570 lb., which will set the drum post brakes. This over-speeding device or governor is of the fly-ball type, and it will be caused to operate by an excessive speed, whether due to motor or a breakage of the hoist parts. The emergency weight may also be tripped manually from the cabin.



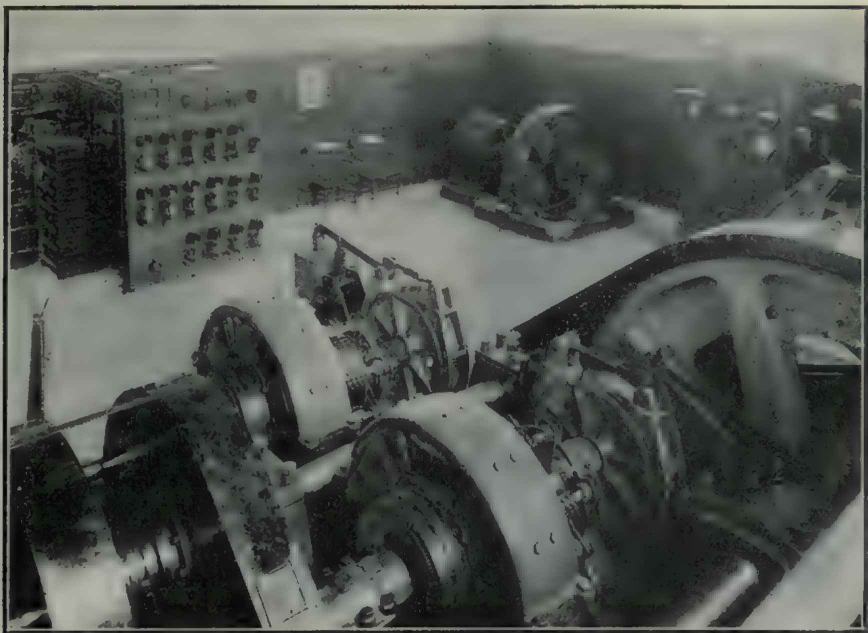
GENERAL VIEW OF POWER HOUSE—MOUNTAIN PARK RAILWAY, HAMILTON, ONT.

Bedplate.

The bedplate, embedded in a concrete foundation, is composed entirely of structural steel, and is approximately 32 ft. long and 18 ft. wide. The main members are made up of two I beams 15 in. high, fitted with suitable spreader plates top and bottom, and thoroughly braced

and riveted. The cross members are composed of 15-in. I beams and 15-in. channels with top and bottom plates suitably riveted.

Where the pillow blocks, side-stands, etc., are mounted on the bedplate, pads are riveted to same and planed so that the various parts of the hoist will line up properly. The bedplate is built in 8 sections to facilitate shipping, the sections being joined together by means of suitable riveted plates, angles and forgings, and by means of fitted machined bolts.


ELECTRIC HOIST SHOWING CONTACTOR PANEL, MOTOR GENERATOR SET AND SWITCHBOARD.

Bearings.

The drum shaft is carried by four low form pillow blocks of cast iron which are 14 in. high from the base to the centre of the shaft, and fitted with adjustable caps. The outer pillow blocks have bearings 12 in. diameter and 18 in. long, while the two other bearings are 12 in. diameter and 20 in. long. The pillow blocks are secured to the bedplate by means of fitted bolts and are provided with suitable keys at each end for purposes of alignment.

The pinion shaft is carried on three A stands 21 in. high, which are of the same general construction as the pillow blocks, excepting that they are not fitted with alignment keys. These A stands have ring oiling bearings 7 in. diameter and 12 in. long. There are also provided ring oiling A stands to serve as outboard bearings for each of the motor armature shafts. These A stands are also ring oiling.

All the bearings are lined with babbit metal which has been thoroughly peened in place, machine bored and hand lapped. All the bearings are equipped with suitable oil wells or cups, and the main pillow blocks are fitted with oil trays to prevent leakage on the foundation.

Shafts.

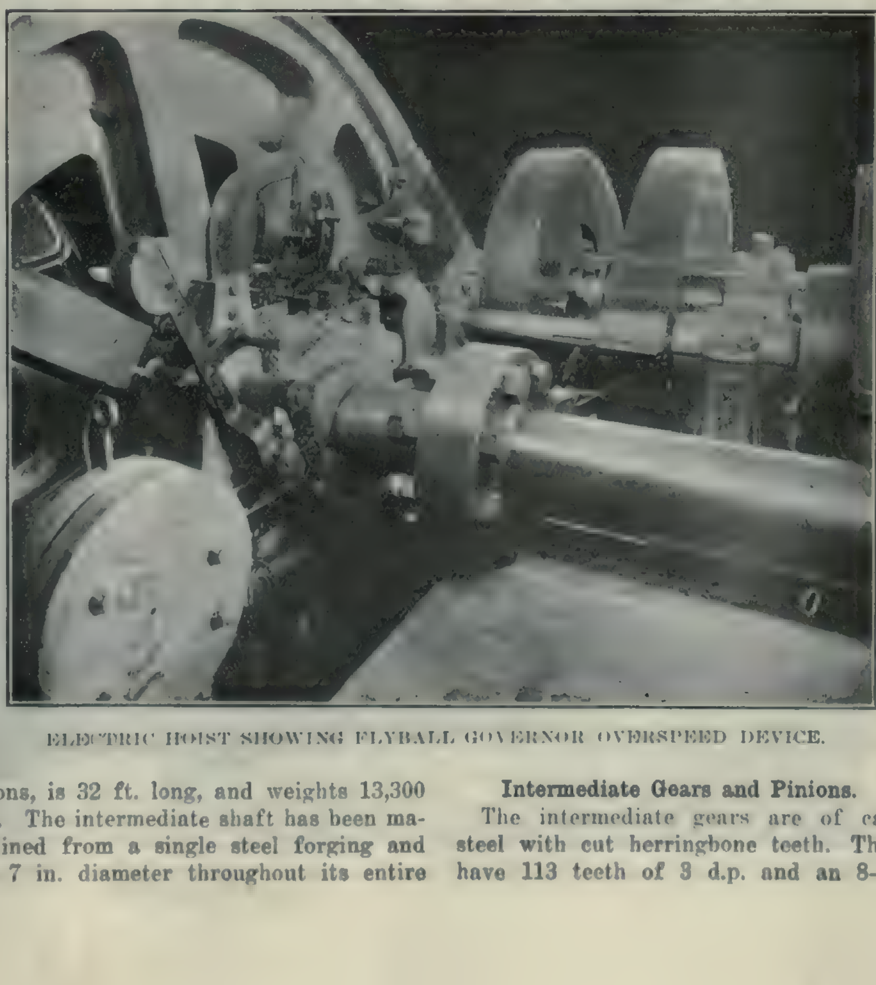
The drum shaft is a steel forging made in two pieces, which are 12 in. diameter. The two pieces are joined together by means of heavy flanges forged integral, and fitted with heavy machined bolts. The drum shaft, including the two sections, is 32 ft. long, and weights 13,300 lb. The intermediate shaft has been machined from a single steel forging and is 7 in. diameter throughout its entire length. It is 20 ft. long and weighs about 3,000 lb.

Drums.

There are two cast iron drums 96 in. diameter by 70 in. face, to coil 800 ft. of 1⅝-in. rope, plus 3 holding coils at each end on one layer. These drums are made up in 2 sections, of barrel construction, and are bolted at one end to the post brake ring, and at the other end to the drum gear. The two sections weigh each 8,350 lb., which means a total weight of drum barrel for each drum of 16,700 lb. The drums have a series of heavy reinforced ribs parallel to drum face and extending from flange to flange.

Drum Gears and Pinions.

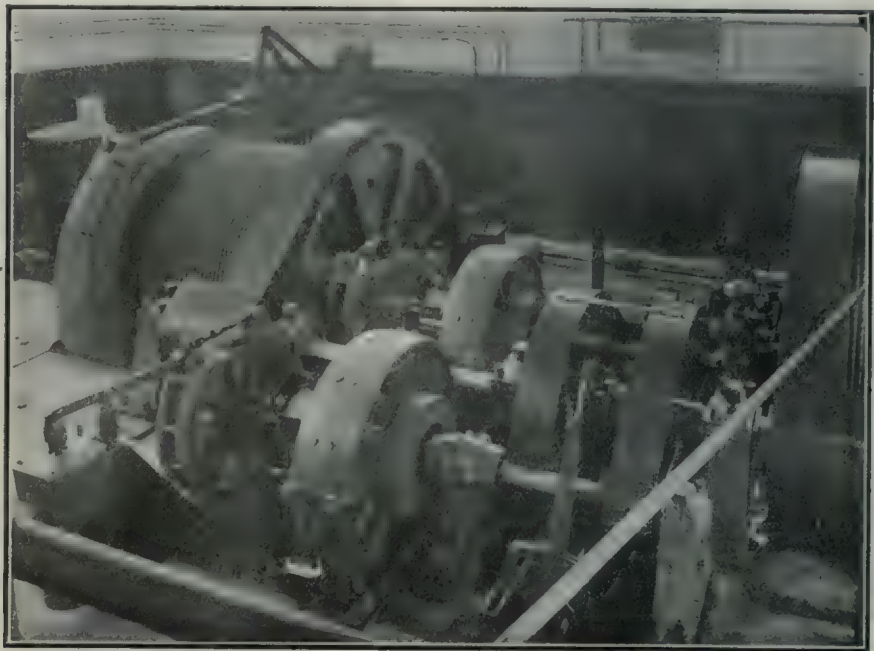
Each of the drum gears is made of cast steel with cut involute teeth, and is of the double arm wheel type having eight arms reinforced by ribs forming an H section. The gear has 122 teeth of 1 d.p., and a 12-in. face width, the pitch diameter being 122 in. As mentioned before, the gear is bolted to the drum barrel by fitted bolts with double nuts. The gear pinions are of forged steel and contain a very heavy brass bushing having a slide fit on the intermediate shaft. The pinions have 21 teeth, 1 d.p., and a 12-in. face width, being 21 in. pitch diameter. The gears weigh 11,900 lb. each, and the pinions, including the brass bushings, weigh 1,200 lb. each.


ELECTRIC HOIST SHOWING FLYBALL GOVERNOR OVERSPEED DEVICE.

Intermediate Gears and Pinions.

The intermediate gears are of cast steel with cut herringbone teeth. They have 113 teeth of 3 d.p. and an 8-in.

face width, being 56½-in. pitch diameter. The intermediate pinions are of forged steel and have 22 cut teeth of 2 d.p., herringbone type. They are of 8 in. face width, and are 11 in. pitch diameter. The gear is of the double arm wheel type, and contains a brass bushing. The gears weigh about 1,630 lb. each.



ELECTRIC HOIST SHOWING BOTH MOTORS, SOLENOID BRAKES AND FLY-BALL GOVERNOR OVERSPEED DEVICE.

Drum Brake Wheels.

The drum brake wheels are of cast iron and are of the double arm wheel type, having 8 arms. They are fitted for post brakes of the V type and the angle between the sides in contact is 68°. The wheels are 108 in. in diameter to the outside of the rim, and as stated above, are bolted to the drum barrels with turned bolts and double nuts. Their extreme width, except at the hubs, is 12 in., and they weigh 9,000 lb. each.

Drum Post Brakes.

The two main drum post brakes are of the double acting type, the wings being composed of cast steel, fitted with V-shaped white maple blocks 10 in. wide, cork inserted. The lower ends of the brake are carried on a cast iron sole plate which in turn is supported by a cast iron plate embedded in the hoist foundation. The sole plate is secured to the foundation plate by means of fitted machined bolts, and in addition there are provided steel keys for the purpose of further rigidity and alignment. The brake is applied by closing the brake wings at the top, which is accomplished by means of suitable bell crank with adjustable connections. Ordinarily, as mentioned before, the setting of the brakes will be accomplished by two hand levers located in the operator's cabin, but in case of emergency, by means of the over-speeding device.

Solenoid Brake Wheels.

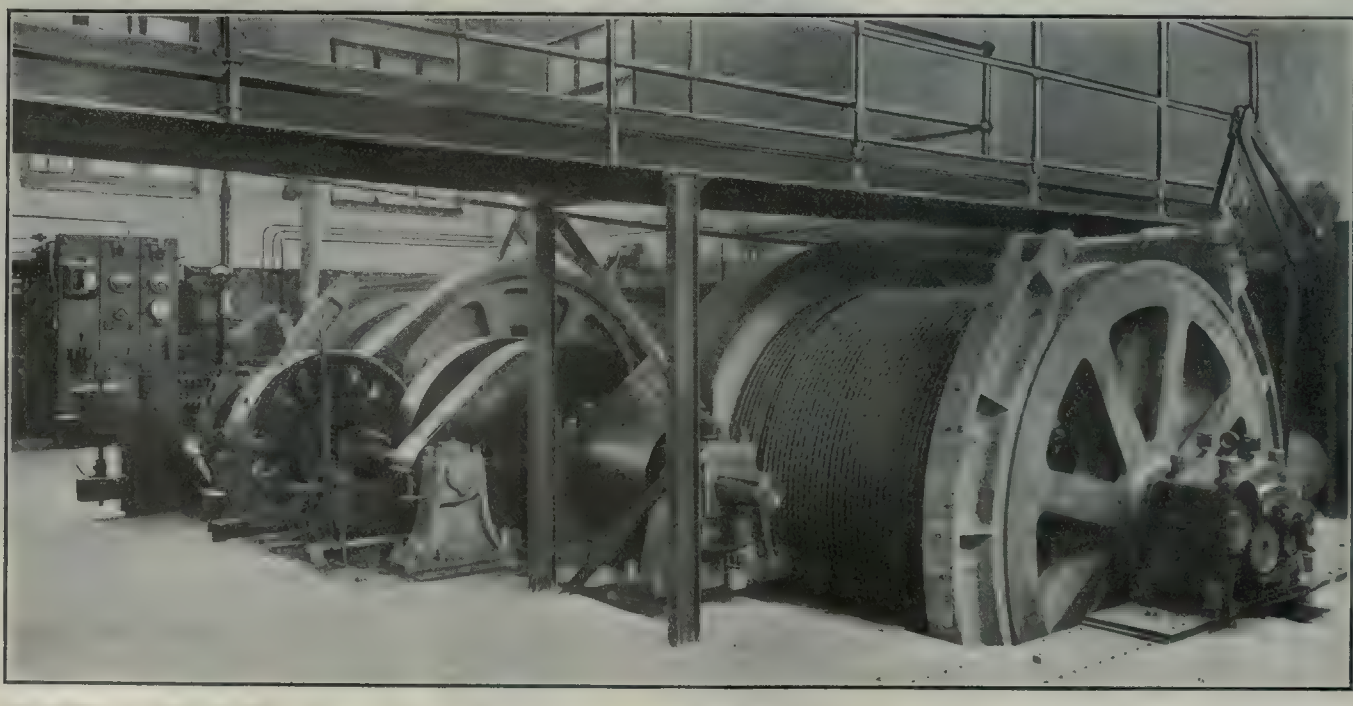
The solenoid brake wheels are of cast iron and of the solid plate type, reinforced by 8 ribs, and fitted for post brakes of the V type, the angle between the sides in contact being 75°. The wheels are 34 in. in diameter to the outside of the rim, and weigh 830 lb. each. Due to the high r.p.m. of these wheels, they are very carefully balanced.

Solenoid Post Brakes.

The two solenoid post brakes are of the double acting type, the wings being composed of cast iron having a V-shaped section lined with raybestos brake fabric. The brakes are set by C.G.E. solenoids, type C.R. 9,500, size S-6-200 lb., having a 5-in. stroke and being series wound for 500 volts with ½-hour rating.

Clutch and Arrangement for Operating Same.

As only one motor will be in operation at one time and two are provided in case of the inability of one to perform its duty, an arrangement is necessary to shift the drive from one motor to the other. This has been taken care of by



ELECTRIC HOIST SHOWING GEARED LIMIT SWITCH ON DRUM SHAFT AT RIGHT, AND INTERPOLE MOTOR AND SOLENOID BRAKE AT LEFT.

a jaw clutch located on the intermediate shaft, which engages with either one of the gears by means of clutch plates, thus transmitting the pinion force to the intermediate shaft, the gear being loose on the shaft. The clutch is shifted by a lever operating in a notched quadrant, and two clutch-locking levers balanced by weights are provided in conjunction with a small plate attached to the clutch lever which prevents the clutch from working out, and positively locks clutch in position.

Electrical Equipment.

Power is supplied in the form of 3-phase, 25-cycle, alternating current, and for transforming this to direct current a Canadian General Electric motor-generator set has been installed of sufficient capacity to supply the average demand of the hoist, plus some surplus for charging the battery described below. The direct current end of this machine is rated at 165 amperes continuously at 550 volts, the latter being the floating voltage of the battery. This generator is driven by a 2,200-volt induction motor. The generator end is designed with a special drooping characteristic, by means of a reversed series field, for the purpose of throwing load fluctuations on the battery. A small percentage of the load fluctuations falling on the machine will lower its voltage to such an extent that the battery must discharge and furnish the balance of the momentary demand. The regulation is, therefore, inherent in the design of the machine, and is entirely automatic.

The hoist is driven through two gear-reductions, the total ratio of which is 29.84 to 1, by a General Electric 189 horse-power, 500-volt, 475-585 r.p.m. direct current motor which is especially designed to stand such voltage variations as come from a storage battery when it is frequently charging and discharging. The motor is controlled by a General Electric magnetic contactor panel, so that it is convenient to control the motor remotely from the operator's station. This system control admits of the various protective devices already described, and ensures against the cage operating at greater than a predetermined speed. A General Electric master controller and foot-operated safety switch are installed in the operator's cabin.

To ensure a greater degree of continuity of service, a reserve General Electric 180-h.p. motor and solenoid brake are provided. The machinery of the hoist is so constructed that in a very few moments' time one motor can be disconnected from the hoist and the other clutched-in ready for service. The power plant has been supplemented by a storage battery built by the Electric Storage Battery Co. of Philadelphia, one of the objects of installing this being to reduce the maximum peaks due to the fluctuating load of the hoist, and thus reduce the power bills. Another object was to furnish current for operating the hoist if the alternating current supply is interrupted.

The demand of the hoist motor when lifting a load of 7½ tons was estimated at 470 amperes for ten seconds, followed by a demand varying from 410 down to 230 amperes for a period of 80 seconds, the voltage being approximately 550 volts. Under the conditions of maximum schedule, it was estimated that the load period of 90 seconds, mentioned above, would be followed by a 3 minute rest, thus providing for a trip of the hoist every 4½ minutes.

For handling a 10-ton load, the maximum ten-second demand was estimated at 530 amperes followed by 80 seconds of load varying from 470 down to 310 amperes. The hoist is designed to handle a 15-ton load occasionally, but this will not occur when the battery is handling the entire load with the power supply cut off. It is believed that hoisting a 7½-ton load every 4½ minutes will represent the average conditions during the hours of maximum traffic. The average load is 112 amperes on this basis.

Storage Battery.

The battery consists of 262 cells of the Tudor-Box type. Each cell contains 11 plates, Type F., measuring approximately 11 in. by 10½ in., five of the plates being positive of the Tudor type and six of the plates being negative of the Box type. The plates are supported in glass jars mounted on glass sand trays, the entire battery being installed on wooden racks. The capacity of this battery is 200 amperes for one hour on continuous discharge. For intermittent service extending over several hours the ampere hour capacity will be somewhat greater, and it is estimated that this battery will operate the hoist under the average load conditions cited above over 1¾ hours with the power supply entirely cut off; or if the schedule be reduced so that trips are made less frequently, the hoist can probably be kept in operation for several hours.

Under normal conditions with the motor generator supplying the average load, the battery does not become exhausted, but receives back sufficient charge during the period of rest between trips to make up for the discharge while the hoist is in operation. The battery, therefore, while relieving the motor generator and power line of the severe load fluctuations, is maintained at all times practically full and ready to supply the entire demand in case of interruption to the power supply.

CANADIAN RAILWAY CLUB ANNUAL.

THE thirteenth annual meeting of the Canadian Railway Club, Montreal, was held last week, when reports of the past season's work, the election of officers, a presentation to the retiring president, etc., constituted the principal business transacted.

Officers were elected as follows: President, L. C. Ord, C. P. R. Angus Shops; first vice-president, R. M. Hannaford; second vice-president, George Smart; executive committee, Messrs. T. C. Hudson, E. E. Lloyd, J. Hendry, C. Manning, E. B. Tilt and Prof. H. O. Keay; audit committee, Messrs. W. S. Atwood, W. H. Winterrowd and W. S. Purdy; secretary, James Powell; treasurer, W. H. Stewart.

The annual report of the secretary showed that the attendance at the monthly meetings had been the best in the history of the club and that the membership had now amounted to 800, of whom 73 had joined during the twelve months. The loss sustained by the death of Lieut.-Col. Lacey Johnson was referred to in appropriate manner, and the secretary drew attention to the fact that four other members had died during the year.

The financial statement showed that the club has a balance of $3,063.91. While this is slightly less than the balance shown at the last annual meeting, it was explained that the dues of all members who had gone to the front had been remitted. Those serving with the forces are Messrs. W. C. Brotherhood, J. M. Eakins, P. H. Henson, W. T. Hawes, L. G. McNab, F. G. Goddard and J. R. Thomas.

On behalf of the membership, T. McHattie presented to the retiring president, William McNab, a gold medal commemorative of his term of office, in acknowledging which Mr. McNab declared that it would be a reminder of one of the most pleasant years of his life. At the smoking concert which followed, Messrs. J. T. R. Hicks, Sam Dunn, H. W. Hesketh, J. Aspinall, J. Hunter and C. Kelso were heard in songs and recitations.

An interesting point was brought out at the recent sales conference of the Goodyear Tire & Rubber Co., Akron, Ohio. The company's statistician announced that each of the 500 salesmen sell enough goods to keep 15 workmen on the payroll at Akron. The company employs 7,500. Most of these are married, and the statistician figuring an average of two dependents per workman shows that Goodyear salesmen produce means of life for 22,500 Akron people.

PRODUCTION METHODS AND DEVICES

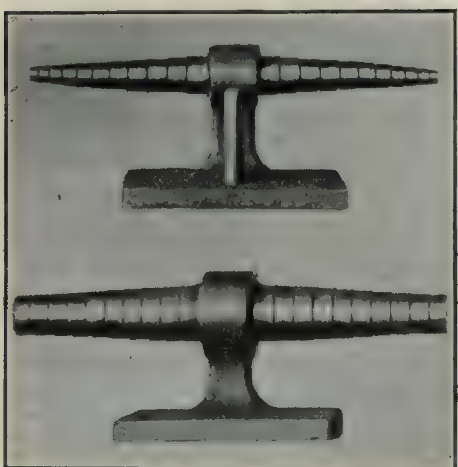
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

CONVENIENT FORM OF CALIPER GAUGE.

By J. P. S.

IN spite of the fact that solid gauges and micrometers are being used more and more in gauging standard sizes, the old-fashioned caliper is still very much used, and when equipped with suitable gauges possesses some advantages. The essential point in accurate measuring with calipers is an educated sense of touch. The skilled mechanic measures thousandths by the feel, and not by adjustments of the instrument.

It is very difficult for even experienced men to take accurate sizes from a scale or even from a micrometer. For convenience, quickness, and accuracy in this work, it is best to provide a gauge similar in general form to the work to be measured, so that the feel of the caliper may be the same on both gauge and work. Two such gauges are shown in the accompanying illustration, and are



STANDARD CALIPER GAUGES.

in continuous use in the plant of the Canada Machinery Corporation. Although not a new idea, these gauges have been found to prevent considerable spoilt work and to make possible accurate measurements from men who were otherwise more or less uncertain.

These gauges may be made up in sizes suitable for the range of work of the plant using them. We have seen them with each step representing a standard size of shafting, and each step subdivided for running, push, and force fits, a line representing the centre in each area. Another decided improvement is to fit a ring on the ends larger than the smallest diameter to protect the tool from injury by falling and injurious contact with other tools or machinery.

SLOTTING SCREW HEADS.

By G. Avery.

A FIXTURE used for slotting screw heads is shown in Fig. 1. By using this device, screws can be slotted almost as

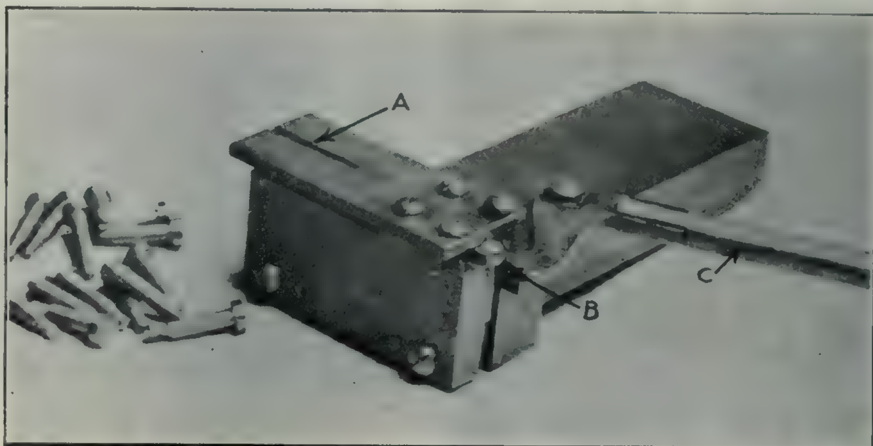


FIG. 1. SCREW HEAD SLOTTING FIXTURE.

fast as the operator can handle them. The fixture is bolted to the milling machine table and set so that a milling saw will run in the slot A at the right height to properly slot the screw heads as they are fed under it. The screws are inserted at B by the left hand of the operator while his right works the lever C. The stroke is such that, when the lever is pulled forward as far as possible, a cut is completed on one head. No clamping device is needed as there is no tendency of the screws to spin or chatter to any extent. In order to show the simplicity of this fixture, it is shown in Fig. 2 with the top cover of the holding slot removed. As fast as the screws reach the end of the holder they drop off into a box set to catch them.

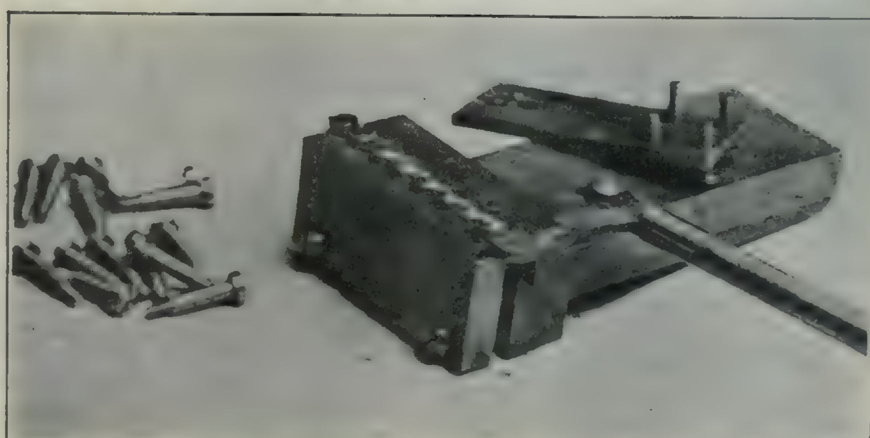


FIG. 2. SCREW HEAD SLOTTING FIXTURE WITH TOP COVER REMOVED.

PIPE PATTERNS AND CASTINGS.

By A. Midgley.

THE accompanying article formed the subject of a lecture recently before the Halifax Branch of the British Foundrymen's Association. Patterns and castings were discussed relative to straight pipes, standard tees, elbows and specials.

Straight Pipes.

For a few years there was in use at the foundry at which the author was employed a range of wood models varying from 4 in. in diameter to 24 in. diameter. The patterns up to 9 in. diameter were made in two solid halves jointed and dowelled. The flanges were made to fit the diameter of the prints, this being better than recessing them into the print when the pipes were subject to con-

stant alteration. The prints were 6 in. long, and in those sizes of pipes which were most in use, several lengths were made, 9 ft., 6 ft., 3 ft., 2 ft., 12 in. and 6 in. Thus it was possible to avoid extra long boxes for short pipes and also to make a great many pipes of the same diameter, but varying in length, on the same day.

Above 9 in. diameter the pipe patterns were lagged up on bearers or circular blocks, these blocks in most cases being gussetted on one side in preference to crossing the grain at right angles as believed to be the usual practice. By this method, the diameter of the pattern remained more correct and for a longer period than by crossing the grain. Care should be taken to have the gussets at least as thick as the timber used for the bearers. These patterns served their purpose for a number of years, but as the number of pipes required increased, it was decided to lay down a range of iron models from 4 in. to 9 in. diameter inclusive, with suitable boxes, and these proved a decided advantage.

The iron models were made in 9-ft. lengths with due allowance for contraction and machining. They were turned up to correct diameters all over, flanges included. The flanges were recessed into the pipe at each end ¼ in. below the diameter of the print, this ensuring that they sat perfectly true on the pipe without being fastened. The prints were respectively 9 and 12 in. long, the longest coming well out of the end of the box and having 1½-in. diameter hole drilled through, this hole enabling the moulder to insert a bar and give the pipe a slight turn before removing the top part, thus breaking any adhesion that might exist between the pattern and the sand and giving a perfectly clean and satisfactory mould.

Where square or rectangular flanges had to be used they were provided with a centre dowel and suitable hole in the recess of the pipe to ensure that each flange would be square with the other, also all flanges were provided with a fillet, as the absence of these would sometimes cause the flange to draw away from the body of the pipe. Fillets should never be made so big as to interfere with bolt heads.

Standard Tees and Elbows.

These were used in great variety. They were all wood models with half coreboxes, and it had been found that very seldom was more than half needed, especially when the elbow or tee was set equal either way. These were made in the usual way, and scarcely required describing.

Specials.

Great numbers of these were made, spring bends, S-shaped bends., Y-shaped bends and almost every shape of pipe known to the trade. A series of large pipes including taper pipes and elbows tapering from 39 in. to 36 in., some with flanges at both ends and some with one flange and bell-shaped at the other end had just been finished at the author's foundry.

In handling these pipes, the same method was followed as adopted with template pipes. Formerly when a template pipe order was received from the drawing office, although all the information possible was given, there was much left in doubt. A template pipe was a pipe which had to fit between two existing pipes, and if the angles of the flanges were not correct, when being put into its final position on the job a great amount of work was caused.

On receiving the template, the practice formerly was to try and place it in a position of a level board approximating to the position it would finally occupy. When put into its place on the job for which it was intended that was not always easy, as sometimes very difficult angles had to be obtained. Although generally successful in this part, it was still necessary to transfer those angles and measurements to the loam patterns, a proceeding which was found to be decidedly awkward. A loam pattern was not the best material on which to fasten flanges that needed to be accurate, and although a great amount of thought and ingenuity was devoted to the matter only indifferent success was attained, for however accurately the flanges might be placed on the loam pattern there was always the danger of these being disturbed before they were finally rammed up in the mould. The present method of dealing with template pipes was:

Improved Method Adopted.

The total length of the template was measured to decide the amount of contraction required, and any special features were noted. Next half-circular pieces were prepared to fix on each flange, these pieces being made thick enough to provide for contraction and a definite amount of machining in the total length of the pipe. To these were affixed half-circular prints made to the size of the box of the pipe. In fixing these to the template, care had to be taken to see that they were parallel on the joint, as by so doing a perfectly true joint was ensured.

The next procedure was to make a core-plate to follow the contour of the pipe, from which plates were cast and from which the coremaker struck up the loam core, afterwards striking the required thickness of loam on to make it the size required for the pattern. Two strickles were prepared, one for the core and one for striking on the thickness of loam for the metal.

Assuming that the core and pattern were ready the moulder bedded the template into the floor in the ordinary way, rammed up to the joint of the flanges, and there made a joint half-way (round the flanges only). Two stakes or files were then driven into the sand against the outside face of the flanges, these being allowed to project against the joint in order to ensure the top half of the flange following the same angle as the bottom half.

The template was then drawn out of the sand and two half-flanges were dropped into the impressions left by the template. The loam pattern was placed between the two flanges, the top halves of the latter being placed on the top of the pattern and rammed up in the ordinary way. When the pattern was liberated by the moulder, the extra thickness allowed for metal was taken off, leaving the core, which was now dressed off ready to go back into the mould. This method was found to be more sure and much easier than any other they had tried.

ORGANIZING THE ENGINEERING INDUSTRY IN WAR TIME.

CONSIDERABLE attention has recently been devoted to the organization of engineering, shipbuilding and metal working plants in Great Britain with a view to their meeting satisfactorily the abnormal demand not only for the actual munitions of war, but for the equipment, as well, necessary for the production of the latter. Arising out of broken time of workmen, from causes known and in many instances grossly exaggerated, and from causes real but unappreciated, steps have been taken to bring under Government control and dictum the output feature in a quite broad and comprehensive sense. The following article, taken from a recent issue of The Times, London, England, emphasises the need of caution being exercised in the cessation of normal or peace-time specialty production, and shows that, while it is realized that the supply of war munitions must be paramount, nothing should be done that will be detrimental to set back or nullify legitimate work:

I am the chairman of an engineering concern which is engaged exclusively in the manufacture and importation of machine tools—machines and appliances used for the various metal-cutting operations which are required in the production not only of munitions of war, but of all machinery; and as such I have had access to practically all the engineering works of the country, and have learnt much of the conditions in

the various branches of the trade and of the problems and difficulties with which the industry is faced. Any attempt to organize the engineering industry must operate on the broadest possible lines, dealing first with the means of increasing the total output, and then with the difficulties of detail.

An Organizing Council.

The first step necessary is the formation of a body truly representative of the various departments. Such a body, which might be called an organizing council, should comprise first of all representatives of the two great departments by whom the present demand is initiated—namely, the Admiralty and the War Office. It should comprise a representative of the treasury to deal with finance, one or more strong commercial men with wide experience, one or more practical engineers conversant with manufacturing operations on a large scale, and one or more labor representatives. It should possess the fullest powers, but it should avoid until the last any unnecessary interference with existing management, realizing that our engineering resources if fully and intelligently employed are capable of extending the present output in an extraordinary degree.

The engineering industry must be considered to embrace all metal-producing and metal-working industries, and to comprise such vastly different branches of trade as production of pig-iron; steel in its multitudinous varieties; ships; constructional steel work; guns, small arms, shells, ammunition; locomotives; marine, stationary, gas and oil engines; motor cars, bicycles, machine tools. Each of these trades is highly specialized, and almost all depend on the uninterrupted working of allied trades. Specialized trades take time to build up, their organization and equipment cannot, except in few instances, be rapidly diverted to other purposes, and the organizing council, therefore, should interfere as little as possible with them so long as the Government demand for their productions is unsatisfied.

Take the case of a company specialized for the manufacture of machine tools for use in the armament trade and in the engineering trades as a whole. Such a company possesses a large amount of plant which undoubtedly could be diverted from its legitimate functions to the manufacture of shells, fuses and other direct munitions of war, but its total output on these new productions would be insignificant and long delayed. Meanwhile, the buyers of machine tools, practically the whole industry, would be at once embarrassed.

Objects of the Moment.

It may be presumed that the main requirements of the moment are:—

1—To increase the output of warlike material of every kind.

2—To make such increase in the least possible time.

3—To interfere as little as possible with existing management and methods.

The organizing council would find an immediate necessity for local sub-committees, who would have to collect information as to local conditions and possibilities, digest such information intelligently, report to the organizing council, and act as local executives. The Engineering Employers' Federation, which comprises the bulk of the most important engineering firms and has local committees in all engineering centres, would undoubtedly offer its services.

The organizing council might at once decide and declare the attitude to be adopted with regard to machinery and engineering supplies which are in progress for neutrals and Allies, and are now naturally taking their ordinary course. No doubt the Government would hesitate to interfere with work for Allied Governments and their contractors, but the supply of engineering goods to neutrals might probably be interrupted without compunction, and would release considerable quantities of engineering products for the British Government or by their contractors. Many workmen and much material would also be released. The same applied to large orders in hand for departments in the British colonies which are not concerned with the war, and to orders for municipal work. Since it was only after some weeks that the demands of the Government began to be really felt, engineers, if they have to suspend deliveries to neutrals and to other customers, must be protected against claims for breach of contract.

Classification of Resources.

Again, the organizing council would co-ordinate the respective requirements of the Admiralty and the War Office so as to avoid independent action by the two departments. This would clear the air at once and greatly increase output. Reports presented by the local committees would deal with the capabilities of each district firm, the amount of orders already in hand for Government work, and the amount of orders in hand for other purposes. On the basis of these reports the organizing council would classify the engineering firms of the country somewhat as follows:—

A—Government establishments. B—Establishments engaged exclusively, or almost exclusively, on the direct production of munitions. C—Establishments engaged partly on Government work. D—Establishments doing little or no Government work. The leading idea would be, in the first instance, to assist A and B by bringing to their help the full resources of C and D. These reports would be far better than the information at present collected by factory inspectors.

Labor and Efficiency.

Labor will also engage the attention of the organizing council, who would not be influenced towards it by isolated difficulties. It must be realized that the Government are largely responsible for the present labor difficulties by devoting all their earlier energies to enlistment, and by collecting to the colors thousands of the best mechanics. This has resulted in a grave deficiency of labor, which can only be gradually supplied by bringing in and training new men (and in many cases women). While there are isolated cases where production is interfered with by drink, where workmen are unreasonable, and where restriction of output for the purpose of maintaining prices is resorted to, it would be wrong to conclude that such difficulties are universal, and it would be unjust to withhold from the workers as a whole due acknowledgment of their hard work.

The depleted labor market might also be fed to some extent by the suspension of public and municipal works. The congestion of railway traffic, and particularly the congestion at the docks, needs prompt handling. Bodies of troops under training might be utilized in cases where dock workers refused to put in proper work, and the removal of congestion would at once expedite transport work, and free immense supplies of machinery and munitions which are reaching us by sea.

The organizing council could then turn to the equipment of new establishments for the production of further supplies of munitions, as soon as it was assured that existing establishments had really been assisted to increase their output to the maximum and that machinery, material, and labor were ready.

The British War Department is looking around for gases to use against the Germans. The Toronto Telegram is prepared to recommend that General Hughes make speeches in the British trenches when the wind is favorable.

* * *

The millwright who depends on figures alone and never uses a speed indicator is very likely fooling himself as to some of the machine speeds. Strange things happen at times in power transmission, and the only way to keep exact track of them is by checking up the figures against speed indicators now and then. It is like a navigator proving up his dead reckoning by taking observations from the sun now and then; it corrects errors.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

LEVERS.—I.

THE lever is one of the simplest and yet most universally used of all the mechanical powers. This simple piece of mechanism is very often employed in parts of machinery, in such a disguised form as to be almost unrecognized by the average workman.

The simplest form of lever is a rigid bar, which turns about a point called the fulcrum. The two arms which compose the lever are called the power arm—taken from the fulcrum to the point where the force is applied—and the weight arm—taken from the fulcrum to the point of resistance. There are three classes of levers, according to the position of the fulcrum in relation to the power applied and the resistance.

(1)—Where the fulcrum is between the power and the weight.

(2)—Where the weight is in the middle.

(3)—Where the power is between the fulcrum and the weight.

In all levers the power multiplied by its distance from the fulcrum will equal the weight multiplied by its distance from the fulcrum.

Compound levers are two or more simple levers working in a train, where the long arm of one lever acts upon the short arm of the other. This can be more clearly understood by referring to chart 49, which gives the necessary formulae for the solution of same.

A shaft of iron is held between the centres of a lathe. To straighten this shaft, a bar 4 feet long is used. If three inches back, a heel or fulcrum is made upon the tool rest, and a man exerts a force of 180 lbs. upon the outer end of the bar; what pressure is exerted upon the shaft?

This is an application of a lever of the first order, and from the formulae given in chart 49, we have:—

$$W = \frac{PL}{l} = \frac{180\times45}{3} = 2{,}700 \text{ lbs.}$$

The application of a lever of the second order is similar to that of the first, but the lever of the third order is one that acts at a disadvantage when viewed from a power standpoint. It has, however, the advantage of raising the weight through a greater distance than the force applied.

A weight of 80 lbs. is placed at the extreme end of a 42 in. lever, what force is required 20 inches from the fulcrum to raise the weight, the fulcrum being at end of lever?

By formulae:— P:W=l:L, or

$$P = \frac{WL}{L} = \frac{80\times42}{20} = 168 \text{ lbs.,}$$

where P = power applied; W = weight or resistance; l = weight arm, and L = power arm.

In the compound lever shown on chart 49, what weight will a force of 100 lbs. raise if the three power arms L, L¹, and L² are 20 in., 18 in., and 22 in., and the three weight arms l, l,¹ and l² are 5 in., 4 in., and 8 in.?

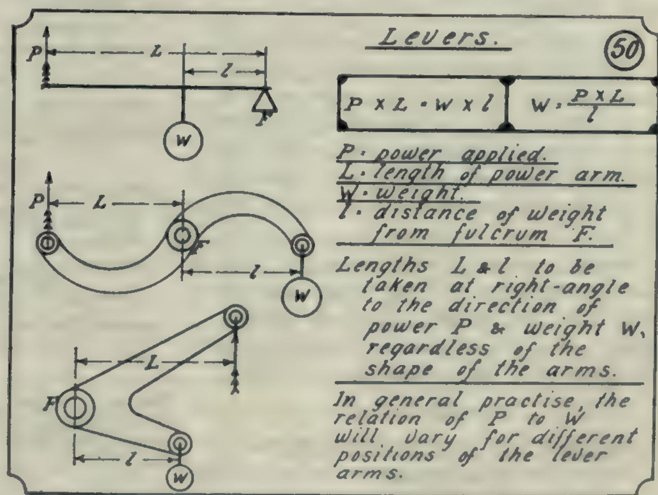
By formula:—

$$W = \frac{P\times L\times L'' \times L'}{l\times l' \times l''} = \frac{100\times20\times18\times22}{5\times4\times8} = 9{,}900 \text{ lbs.}$$

In general practice the lever will often require a shape that may appear to depart from the principle of the simple lever, but the shape is only a question of design, to add appearance, or to meet the requirements of local conditions, it being often necessary to meet certain needs and yet prevent interference with other parts of the same mechanism.

As is shown in chart 50, the length of the arms (for calculation) is always taken at right angles to the direction of the weight, or applied force. In practice the length of the arms of most simple levers will vary according to the different positions in which they are are placed.

ARITHMETIC CHART 49.



ARITHMETIC CHART 50.

NICKEL DEMAND TAXES CANADIAN OUTPUT.

THE unprecedented demand for nickel, largely for the manufacture of munitions of war for the allies, has necessitated a further increase in the output of the leading producers of the Copper Cliff, Ont., district.

The reverberatory furnace department of the Canadian Copper Co. was started up last week for the first time since last August. This will take care of all the fine ore from the mines not used in the blast furnaces, as well as the flue dust, and will smelt some 15,000 tons of ore a month. The ball mill and wedge furnace plant will also be put in operation to pulverize and roast the ore for the reverberatory.

Even with the present smelter going full blast the output will not be sufficient to meet the demand, and the construction of a new 25-foot blast furnace has already been begun. This is larger

than any blast furnace in the district, though it is surpassed in size by some of the furnaces in the West. It is planned to have the new furnace in operation by fall.

More ore is being mined at the Creighton mine than ever before, and preparations are being made for a considerably increased production. Already work has been begun on the sinking of the new inclined five-compartment shaft, and, in addition to this, a complete new hoisting and rock crushing equipment will be installed.

When complete, the new hoist will be surpassed by only one mine on the continent, namely, at North Butte. Many new houses are being built and many others transported on flat cars from the company's town at No. 3, Frood mine, which has been closed down since last August.

The demand for nickel has resulted in the International Nickel Company increasing the dividend on its common stock. A large number of the employees of the Canadian Copper Co. are holders of this stock, a certain number of shares being allotted to each employee yearly, under a plan similar to that in force at the U. S. Steel Co. and several other large plants.

The war has been the principal cause of the big demand for nickel, as the metal is used in cartridge cases as well as in armor plate, which averages 3 per cent. nickel. Nearly all the nickel is now sold in the metallic form, while before the war nearly half was sold as oxide.

Varying percentages of copper are also contained in all the ores, and the fact that this metal has been selling around 19c has increased considerably the profits of the companies operating.

SHELL CONTRACTS OVER $154,000,000.

IN a recent interview, Brig.-Gen. Bertram, chairman of the Canadian Shell Committee, is quoted as stating that shell contracts for the Imperial Government so far awarded in Canada amount to over $154,000,000.

Four months ago (February), the committee commenced shipping the shells, the average shipment then per day being five hundred shells. The daily shipments are now stated to average ten thousand, and before the first of July these must be brought up to a daily average of forty thousand. This must be done in order to complete the order before its expiration date at the end of the year.

The number of plants working upon the contracts let out by the committee have been steadily increased, until at the present time every available machine shop, railroad shop and other plant capable of turning out shells or parts of shells is working to capacity.

"As an instance of the efficiency of the work," Gen. Bertram is quoted as saying, "the first contracts we placed for 200,000 shells were completed exactly one month ahead of time. That was an excellent piece of work." Four hundred and thirty thousand shells have, we understand, already been shipped from Canada.

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION CONVENTION.

THE official programme of the thirteenth semi-annual convention of the National Machine Tool Builders' Association, to be held May 20 and 21, at the Marlborough-Blenheim Hotel, Atlantic City, has been issued as follows:—

THURSDAY, MAY 20.

Morning Session.

9.00 to 9.30 O'clock.

Registration of members.

Roll call.

Reading of minutes.

Report of membership committee, J. H. Drury, chairman.

Announcement of auditing, resolutions and press committees.

Call for resolutions.

Reports of officers and committees.

10.45 O'clock.

Address—"The Application and Use of Time Study Data," Robert I. Kent, editor, Industrial Engineering, New York city.

12.00 O'clock.

Address—"How to Profitably Operate a Night Force," Harold C. White, superintendent of assembling, Pierce-Arrow Motor Car Co., Buffalo.

Discussion.

Afternoon Session.

2.00 O'clock.

Lathe committee.

2.30 O'clock.

Sensitive drilling machine committee.

Boring machine committee.

Gear cutting machine committee.

Grinding machine committee.

4.00 O'clock.

Hand screw machine committee.

Planing machine committee.

Other committees on call.

FRIDAY, MAY 21.

Morning Session.

9.00 O'clock.

Multi-spindle drilling machine committee.

Milling machine committee.

10.00 O'clock.

Shaping machine committee.

Vertical drilling machine committee.

11.00 O'clock.

Turret lathe committee.

Radial drilling machine committee.

Other committees on call.

Afternoon Session.

2.00 O'clock.

Address—"Drop Forgings," A. M. Tilton, president, Drop Forging Co. of New York, Jersey City, N.J.

3.00 O'clock.

Address—"Neutrality," George Grafton Wilson, professor of international law, Harvard University.

Executive session.

Adjournment.

CHAIN DRIVE DEVELOPMENT

THE adoption of electric driving for every class of machinery has given rise to many special problems in power transmission. In the early days the usual practice was either to drive the whole existing shafting by means of a motor or to split up the shafting into sections, each motor-driven. Belt drives were employed in both cases. The economies and other advantages of group driving led naturally to the adoption of individual drive for machines which were not run continuously in unison with their neighbors. With this increase in subdivision the driving of each machine became a proposition by itself, to be solved by the selection of the most suitable type of motor, controller, and the transmitting connection between the motor and the machine. Only in rare cases is a direct drive from a high-speed motor permissible.

Relatively to other modes of transmission, the chain gear has made the greatest advance. It has made this advance in face of the conservatism which prefers to put up with the known disadvantages of belts and meshed gears rather than adopt a solution which involves a novelty even more problematical than the motor itself. Credit for such rapid progress is due to the high standard in design and manufacture achieved by the chain-makers. The problem of producing a chain which will run noiselessly, with a minimum of friction and wear, and without "stretching," is an unusually difficult one, but it has been satisfactorily solved. The solution provides an efficient positive drive which is extremely space-saving and extremely flexible as a speed reducer.

The chain drive, in fact, is a high-class job, and, like most high-class jobs, it is a saver of money in the long run. Our manufacturers are often accused of faults which they do not possess, but they often suffer from a tendency to prefer the cheap in first cost to the ultimately economical. This tendency ought to be resisted by consulting engineers and others to whom manufacturers turn for advice. When a mechanical improvement is analysed, one will generally find that it implies an increase in capital cost with a reduction in running costs, at least in relation to output. Machinery itself is of this character. The electrification of a factory is of this character, and such refinements as chain-driving and ball bearings justify their existence by the money they save day by day.—Engineering Review.

Just as it was with belts, so it is with motors—some men get better service, with less trouble than others. There is always something in knowing how to care for and use equipment.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

CARE OF BELTING IN MANUFACTURING PLANTS.

By P. W. Blair.

TO get the highest efficiency in power transmission is still a problem confronting the manufacturer of all kinds of product. Leather belting and gears are the best known power transmitting agents. Although during the last decade other transmission mediums have been placed on the market, leather belting still maintains a leading position. It has demonstrated its ability to stand more abuse and high speed and come out alive than any other means of power transmission.

The Belt Man Feature.

It is an undisputed fact that if leather belting be given the proper attention, which of necessity must be given same to get the full amount of wear out of it, results will demonstrate beyond question its high degree efficiency and economy. To promote this efficiency and economy in an up-to-date plant no matter the size, one of the first conditions is that the entire care of the belting shall be entrusted to one man, that he shall be held solely and fully responsible for it and that no repairs or alterations of any sort may be made or dressing applied except by him or under his immediate direction.

Some may think this arrangement unnecessary, as their plant is not large enough. No manufacturing plant, however, is so small and none so large as to prejudice remunerative returns. It is a necessity because it makes some one man responsible, thereby insuring that attention is given when needed and not when it is too late for the stitch in time. It also insures as far as may be uniform treatment of the belting, a powerful factor in determining its efficiency and life. It makes possible the keeping of a record of repairs of the term of service of individual belts.

The man selected for the position should know of what the proper care of leather belts consist, of the making of laps, the taking up of belts and their repair. He should be provided with the necessary equipment for doing all ordinary belt work. It should be the duty of the belt man to make a careful and systematic inspection of all belting at definite and frequent intervals. Again, by keeping records of the different belts and their repairs, it gives you the cost per year of belt upkeep on each individual machine or pulley.

It is a fact that in the average shop very few belts wear out legitimately. They are ruined through accident or improper attention—usually the latter. A narrow belt properly maintained and the tension at the right point will transmit more power than a wide belt in poor condition and running as slack as they are usually allowed to run in the average shop. If the belt is too tight it means waste due to friction, if too loose it means loss due to slip. A few fundamentals on the care of belts are as follows:—

Belt Care Fundamentals.

1—Do not run double belts on pulley less than 6 ins. diameter, or triple belts on pulleys less than 20 ins. diameter.

2—Pulleys should be 20 per cent. wider than the width of the belt.

3—Never let belt touch shifting devices or lap steps of cone pulleys.

4—Belts should run with hair-faced side to pulleys.

5—Outside points of splices should trail when running to avoid opening by the action of the air.

6—Belts should sag into pulleys and not away from them .

7—Run up-and-down belts on a slant.

8—Avoid very short drives.

9—Keep pulleys clean.

10—Clean belts at regular intervals and apply a dressing that will give the grain side a soft and adherent surface.

11—Remedy all faults in their early stage.

The tightness with which belts are put on the pulleys is of fundamental importance. If too tight there is a large, unnecessary loss of power from excessive friction at the bearings, to say nothing of the fact that the leather is overstrained and injured. On the other hand, if the belt be too loose, the belt is liable to flop around and jump from the pulleys, particularly when working where a load is suddenly thrown on or off. When the belts are put on and taken up under the direction of one man, the errors of too tight and too slack belting are avoided and a uniformity of belt tension exists throughout the factory or plant which can be obtained in no other way. Of course, it is evident that the slacker a belt can be run up to a certain point and do its work satisfactorily, the greater the economy.

In installing belting and taking it up, consideration must be given to the fact that certain kinds of belting are affected by weather conditions, lengthening and shortening, according to the moisture in the air. This is particularly true of certain makes of Chrome leather belting instances being known where babbitt has been melted out of boxes and shafting strained as a result of such belting being put on too tight.

There is more belting ruined by improperly lined shafting and pulleys than in any other way. The belts under this condition are either kept on the pulleys by guides or rub against hangers or portions of machines until a lap is started, thus catching the belt and tearing it open or stretching it excessively on one side. Belts so stretched will not run straight and are apt to run off the pulleys and become torn.

In all replacements as well as in the initial instalment, economy should not be the only thought. It is a very simple matter to connect two pulleys by a band in such a way that when one pulley is turned the other will go around. It is not, however, a simple matter properly to proportion a drive and select the size and quality of belting which will transmit power most efficiently and economically. Yet the problem seems so simple that it more frequently than not fails to receive the necessary consideration, and a common result is that belting is condemned when really the man should be condemned who asks the belt to work under the given conditions. Most belt troubles would never appear if the design and installation of the belt equipment were placed in competent hands.

It may be stated as a general rule that the use of the best quality belting of weight and pliability adapted to the work required will pay good dividends in lessened repairs, increased life of belting and increased output of machines. Sticky belt dressings are best avoided. Neat's foot oil will be found a good leather preserver. All new belts should have an application of same applied on both sides before being put in use or when the belts become dry. There are now a number of belt lacing machines on the market which are proving very satisfactory. They can be brought right to the point where the breakdown happens to be.

All belts should be inspected periodically so as to anticipate breakdowns and also to see that they are kept clean and pliable. Repairs should be made out of working hours.

PRACTICAL NOTES ON ROPE TRANSMISSION.

By H. Womersley.

ROPE driving is divided into two systems, the British or multiple system, and the American or continuous system. Each system has its particular advantages and the user must study which is best for his particular purpose.

British System.

The British system consists of one or more separate and independent endless ropes driving by the natural tension due to the weight of each rope, and the adhesion or wedge action due to the angle of the pulley grooves. No tension carriage being employed, the driving and driven sheaves should be located far enough apart to obtain the required tension. One advantage of this system is that in case one of the ropes breaks, the drive can be operated until replacement is made. The multiple system is not adaptable for vertical drives. When installed with due regard to suitable dimensions, are of contact, relative positions of pulleys, and number and size of ropes for the power to be transmitted, the result is practically positive, steady and noiseless, with immunity from breakdowns. By having a few spare grooves any further addition of power is immediately available.

If cotton ropes are used, it is essential that the pulleys should not be less in diameter than approximately thirty times the diameter of the ropes which are to run in same. For instance, if ropes 1 in. diameter are decided on, the least pulley should not be much below 30 ins. in diameter, and if 2 ins. diameter ropes are to be used, the least pulley diameter should be about 60 ins. If Manilla or hemp ropes are used, the smallest pulleys should be at least one third larger than for cotton ropes. I am aware that these dimensions cannot always be worked to, but it must be understood any radical departure will be at the sacrifice of both power and life of ropes.

The maximum direct driving centres are mainly determined by the diameters of the pulleys and the sag of the ropes; the working, and slack or trailing spans of which must be kept a safe distance apart. It will be readily seen that longer centres are possible when the taut is on the top side. With the bottom taut, the sag of the slack side may be estimated at about 10 per cent. of the pulley centres. When driving conditions and load are of a steady character, best results are obtained when the bottom is the taut side of the ropes, as the slack or trailing span of the ropes on the top side increases the arc of contact.

There are cases when it may be advantageous to have the taut or working side on top, as, for example, saw mill drives, rolling plants, or power taken from oil and gas engines, where the shock is transferred to the driving ropes. The fact of the working strain being on the top side reduces the possibility of the ropes jumping the grooves, as the slack span in which the shock is principally absorbed falls away from the underside, and by its weight helps to neutralize the effect. The best results are obtained when the ropes are working in a horizontal position, or up to an angle of about 45 degrees.

Vertical drives are not recommended, but it is possible to get tolerably satisfactory results if the following is borne in mind:—Have the bottom pulley considerably larger in diameter than the top pulley; have a special groove angle of about 30 degrees, and at least a 25 per cent. increase in number of ropes compared with an ordinary drive. Exposed drives on the multiple system should be avoided, unless arrangements can be made for a liberal amount of sag during dry weather, and a larger factor of safety in the shafts to providing against stresses due to shortening of ropes in wet weather. Watering ropes to take up slack should never be resorted to.

American System.

In the continuous or American system of rope drive, one long rope is wound around the driving and driven pulleys as many times as may be necessary to transmit the required power. The rope is then conducted from the last groove back to the first one, by means of an idler pulley held at the required angle, This idler is mounted on an adjustable carriage to which is attached a weight for taking up the slack of the rope, in order to secure the necessary friction. This system is adapted for vertical drives. The splicing of ropes is a most important matter and should be carried out by experts. For splicing purposes each rope will require to be of an extra length equal to 80 times its diameter.

Slipping of ropes is not due to slackness, but arises through either overloading, ropes being too small in diameter, or groove of unsuitable shape. New driving ropes are lubricated to provide a smooth coating and prevent friction between the twisted surfaces of the strands in contact with each other. A good lubricant is compounded from saponified tallow, wax, and plumbago. Greasy compounds likely to penetrate the fibre should be avoided, but if any have been so treated, a liberal supply of whitening should be used, as this absorbs the grease and falls away in flakes.

It is important when installing rope drives to encase the sides of the pulleys with sheet metal or boards, as otherwise the displacement of air by the arms of high-speed pulleys adds materially to the load. To secure the best results in regard to efficiency and durability, the working tension must be a small percentage of the ultimate strength of the rope. The following formula is a good guide to secure an economical rope drive:—

T=Safe working tension in lbs. per rope.

F=Centrifugal tension in lbs. per rope.

H.P.=Horse power transmitted per rope.

V=Velocity in feet per second of rope.

W=Weight of rope per ft.

D=Nominal diameter of rope in ins.

Then, $H.P. = \dfrac{2\,V\,(T\text{-}F)}{3 \times 550}$

$T = 160\ D^2.$

$F = \dfrac{W\,V^2}{32}$

As the above formula gives power per rope, the total power transmitted equals $H.P. \times N$, in which N equals number of ropes in the drive.

HEAT AND WORK EFFECTS ON METALS.

IN a paper recently read before the Institute of Metals, Prof. A. K. Huntington describes a machine for making alternating bending tests which he erected in 1902 with the object of studying the behaviour of firebox stays at various temperatures. This machine was capable of dealing with 1-in. bars. The results obtained in making a series of tests on copper and an alloy of copper are plotted as curves, which show well defined maxima and minima. These curves are also correlated with ordinary tensile curves.

Besides showing by mechanical tests that definite changes in physical condition takes place in metals with changes of temperature, Prof. Huntington has collected together the results of other experimenters in various directions with the object of making the suggestion that some at least of the maxima and minima are common to different metals. He urges that the study of the physical and mechanical properties of metals should be carried out in future on a broader basis than heretofore, taking into account more fully the effects of these changes of state with temperature both from practical and theoretical points of view.

An interesting and important point brought out in the curves is the way in which the maxima and minima representing changes in the mechanical behaviour of metals with changes in temperature is emphasized by the effects of cold work.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

PROBLEMS RELATING TO MILLING MACHINES.

THE manufacturing milling machine owes much of its success to the fact that it can be used for the production of intricate interchangeable parts in large quantities with comparatively untrained operators. The use of this machine in the tool room, however, involves certain calculations that are rather difficult for the apprentice to understand if he does not receive painstaking explanation of them.

Most builders of milling machines furnish very complete instructions for operating their machines, and these should receive careful study by operators or intending operators. Charts also are usually furnished, but seldom last long in comparison to the life of the machine.

Probably the most useful instruction in connection with milling machines is contained in the old maxim originated by Brown & Sharpe: "Keep the cutters sharp." Care in operating is also necessary, particularly when starting cutters into the work. Few breakages of cutters are caused by the cutting strains of regular work, even when this is excessive, but a great amount of damage can be instantly done to the machine and fixtures by jamming a cutter. It has been found by experiment that cutters last longer and more metal is removed with less power when a fairly heavy cut and definite feed are employed.

* * *

Question.—What depth should the cutter be fed down into a 2 15-16-inch shaft in order to cut a ¾-inch keyway 3-16 inch deep?

Answer.—The usual method adopted by the mechanic is to feed the cutter into the shaft until a flat is produced exactly equal to the width of the cutter and then to sink the cutter the desired amount. This method can also be adopted to centralize the shaft with the cutter.

The height of the segment above the top of the keyway would be $r - \frac{1}{2}\sqrt{(4r^2 - c^2)}$, where r = the shaft radius and c = the width of the flat. Height, then $= 1.46875 - \frac{1}{2}\sqrt{(4 \times 2.1571 - .5625)} = 1.46875 - \frac{1}{2}\sqrt{8.6284} = 1.46875 - 1.42005 = 0.0487$. Whole depth of cut is, therefore, $3\text{-}16 + 0.0487 = 0.1875 + 0.048.7 = 0.2362$ inch.

* * *

Question.—A six-inch milling cutter is to be used and the required cutting speed is 160 feet per minute. What should be the speed in r.p.m. of the milling machine spindle?

Answer.—Circumference of cutter $= 6 \times 3.1416 = 18.846$. Distance required to be covered per minute $= 160 \times 12$. Number of revolutions $= \dfrac{160 \times 12}{18.846} =$ 101.87 r.p.m.

* * *

Question.—A number of rollers 12 inches in diameter are to be milled with 1-inch slots 1 inch deep. If the number of slots is 2,000 and the feed 3 inches per minute ,what would be the difference in the time required when using 4-inch cutters and 8-inch cutters, the table speed being the same in each case?

Answer.—The total depth of the slot = 1 inch plus the height of the arc. The height of the arc is, $r - \frac{1}{2}\sqrt{(4r^2 - c^2)}$, where r = radius of roller and c = width of the flat. Height, therefore, is $6 - \frac{1}{2}\sqrt{(4 \times 36 - 1)} = 6 - \frac{1}{2}\sqrt{143} = 0.021$. Total height is 1.021 inches.

Length of cut, allowing ⅛ inch for waste motion, is 8⅛ inches. The distance a 4-inch cutter must travel to come to its full depth of cut is $\sqrt{(2^2 - .979^2)} = 1.744$ inches. Total travel for 2,000 cuts $= 2{,}000\ (8.125 + 1.744) = 19{,}738$ inches. Time required is $\dfrac{19{,}738}{3} = 6{,}579.3$ minutes, $= \dfrac{6{,}579.3}{60} = 109.65$ hours.

The distance the 8-inch cutter must travel to come to its full depth is $\sqrt{(4^2 - 2.979^2)} = 2.668$ inches.

Total travel of 8-inch cutter for 2,000 slots = total travel for 2,000 cuts $= 2{,}000\ (8.125 + 2.668) = 21{,}586$ inches. Time required $= \dfrac{21{,}586}{3} = 7195.33$ mins. $= 119.92$ hours. The time for indexing and running back will be approximately the same in both. The time saved by using the smaller cutter is, therefore, $119.92 - 109.65 = 10.27$ hours, or about 8.5 per cent.

* * *

Question.—It is required to mill a cutter with spiral flutes, the lead of which is to be 48 inches. The worm gear of the dividing head has 40 teeth and the pitch of the table feed screw is 4. Determine a suitable set of change gears for this purpose.

Answer.—The table advances ¼ inch with each turn of the screw. To advance 48 inches would require $\dfrac{48}{.25} = 192$ turns. The worm requires 40 turns to revolve the work through a single turn, and is driven from the table feed screw. The driver must make 192 turns, while the driven makes 40—that is, the ratio of the gearing is $\dfrac{192}{40}$, or 4.8. If simple gearing be used, all that is necessary is to place some suitable small gear on the feed screw and another on the worm 4.8 times as large, with idlers in-between such as will give the proper direction to the spiral. If a 20-toothed gear be placed on the feed screw, the gear for the worm will have $20 \times 4.8 = 96$ teeth. Also 25 and 120 or 30 and 144 could be used.

In many cases it is more convenient to use compound gearing, or, in other words, two pairs of gears. For this purpose the one fraction is made into two by simply factoring the numerator and denominator of the ratio and multiplying both by numbers that will give suitable gears. Thus, in the above case, the ratio is $\dfrac{20}{96}$. Factoring, we get $\dfrac{4 \times 5}{8 \times 12}$ or the two ratios, $\dfrac{4}{8}$ and $\dfrac{5}{12}$. Multiplying the first by 5, we get $\dfrac{20}{40}$, and multiplying the second by 8, we get $\dfrac{40}{96}$. It will be seen that this combination involves two 40-tooth gears which are not likely to be available. Multiplying by 6 instead, we get $\dfrac{30}{72}$, which is much better. The arrangement is now a 20-tooth gear on the feed screw meshing, with a 40-tooth gear on the stud, and a 30-tooth gear on the stud driving a 72-tooth gear on the worm of the dividing head.

* * *

Question.—A reamer is to be milled with 8 flutes. Plan a suitable indexing of this, so as to stagger the flutes, and thus prevent chattering of the reamer.

Answer.—This is a very simple operation, but certain considerations must be kept in mind. When flutes are stagger-

ed—that is, milled at non-uniform spacing, it is necessary that there be an even number of flutes, and that each shall have another diametrically opposite to prevent warping in hardening.

If the flutes were spaced evenly, exactly five turns of the worm would be required for each spacing. If the circle of 20 holes be added to this, we get a total of $5 \times 20 = 100$ divisions for each flute, or 400 for the half circle. The quantity, 100, is to be varied, but the distance between two opposite flutes must always be 400 divisions. Choose a certain variation, say, 4 divisions or 1-25 of the distance between two flutes. It will be best to draw a circle and divide its circumference into 8 parts by means of 4 diameters.

Beginning at one diameter, mark the first space 100 divisions; the next, 4 less, or 96; the third, 4 more than this, or 100; and the fourth, 4 above the average, or 104. Throughout the four divisions of the other half of the circle, put down the same numbers as have already been placed in the divisions directly opposite—that is, 100 opposite 100, 96 opposite 96, and 104 opposite 104. It will be seen that the distance between any two opposite flutes is now exactly 400 divisions. Ninety-six divisions, of course, means 4 turns plus 16 holes, and 104 divisions means 5 turns plus 4 holes, etc.

* * *

Question.—It is desired to mill nine flutes equally spaced in the circumference of a reamer. The worm gear of the dividing head has forty teeth and a division plate containing circles of 24, 27, 33, 35 and 38 holes is available. What would be the setting of the dividing head?

Answer.—As there are forty teeth in the gear, forty turns of the worm are required to revolve the work through a complete revolution. For one-ninth of a revolution $\frac{40}{9} = 4\frac{4}{9}$ turns of the worm are required. It is evident that, to secure the four-ninths of a turn, a circle with a number of holes divisible by 9 is required, which naturally specifies the 27-hole circle. Four-ninths of 27 gives 12 as the number of hole divisions to give 4/9 of a turn. The number of turns, then, for each flute will be 4, and the sector will have to be set for 12 additional holes.

BEING READY FOR WAR.

"THIS war has brought home to us the necessity of being ready for war," said Lieut.-Col. A. G. Hadcock, of Armstrong, Whitworth & Co., Ltd., at a meeting of the Royal Institution. Lieut.-Col. Hadcock said the manufacturing capacity of Great Britain had been strained to its utmost. We had had to make guns and ammunition in a few months over which other nations had taken the same number of years.

Referring to big guns, the speaker said few people were aware of the extensive knowledge of science and art necessary to construct a gun and mounting. In the construction of some guns, wire is wound round them, and, in a 12-in. calibre gun, the length of this wire was about 130 miles, and in a 13-in. calibre gun about 140 miles, while in some of the latest guns the length of wire exceeded 190 miles. Guns were found to become gradually longer after continual firing. The longer a gun was the quicker it would wear out. The life of a gun depended greatly upon the heat of the gunpowder.

COMING CONVENTIONS.

National Association of Manufacturers; Waldorf-Astoria, New York.—May 18-19.

National Machine Tool Builders' Association, Atlantic City, N.J.—May 20-21.

Master Boiler Makers' Association, Chicago, Ill.—May 26-28.

American Iron, Steel and Heavy Hardware Association, St. Francis Hotel, San Francisco Cal. — May 25-28.

American Supply and Machinery Manufacturers' Association and National Supply and Machinery Dealers' Asociation, Hotel Bellevue-Stratford, Philadelphia, Pa. (Joint convention.)—June 3-5.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Railway Supply Manufacturers' Association. Convention and exhibit in conjunction with the Railway Master Mechanics and the Master Car Builders.—June 9-16.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring Meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

SUPPLY OF WAR MATERIAL.

ALEXANDER ADAMSON, a retired shipbuilder and engineer, who has been connected with the greatest armament, shipbuilding and engineering firms in Great Britain, writes to the Press that from absolute knowledge of all the conditions, he is certain that we could have had now sufficient munitions of all kinds had the great armament firms been told eight months ago clearly what they had to supply.

He remarks that no "superman" is necessary; the organizing ability is there already. He declares roundly that "all this fuss about drinking is simply a red herring drawn across the trail to hoodwink the public and direct attention from the culprits. There is always a considerable amount of drinking among certain classes of workmen, but not enough to turn the country upside down in times like these, or to affect the output to any great extent." This is more or less the general consensus of opinion among those properly informed, and it is clear from Mr. Adamson's statements that he is not writing with bias towards either men or employers.

STEEL INGOT MOULDS.

INGOT moulds made of hematite iron, says Le Génie Civil, have not given satisfactory results, and are now in some works replaced by ingot moulds made of cast steel, which offer important advantages over the cast iron ones. It is true that they cannot be cooled down by water, and that a large area is required to allow them to cool down in the air, but this is the sole disadvantage attendant upon their use. In the manufacture of steel ingot moulds, the core consists of an inner cast iron centre surrounded by straw, on which is put the loam covering, 70 mm. (2¾ in.) thick; this thickness is made up of successive layers, the core being dried in the stove after each layer. When completed, the cores are placed in cast iron boxes lined inside with firebrick and a layer 20 mm. (¾ in.) thick of loam. Cast steel ingot moulds have an average life of 380 castings.

Wiping a Joint.—Open the end of one piece of pipe so that the other piece of the pipe will just enter, then scrape with a shave-hook to size of joint, taking care to keep it perfectly clean. Fasten the two pieces of pipe securely in position, rub bright parts with a tallow candle, and proceed to pour or splash metal on joint, wiping it into shape with a cloth made of several thicknesses of fustian. You will require a metal pot, ladle, bar of metal, shave-hook, turnpin, soil, tallow, rasp, several cloths, and a deal of patience.

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Vol. XIII. MAY 20, 1915 No. 20

PRINCIPAL CONTENTS.

THE CANADIAN SHELL MANUFACTURING SITUATION.

IT is daily becoming increasingly evident that what we were prompted five months ago to dub as "Canada's Impromptu Industry," to wit, the manufacture of shrapnel and high-explosive shells, appears to be still in its infancy, and both through the aptitude with which it has been gripped and the exigencies of the military situation, there is every prospect of its attaining to the full stature of manhood with respect to development and achievement.

The proposal, determination and necessity to have shells manufactured in Canada was, in the closing months of 1914 conceived and nurtured in an atmosphere of zealously and jealously guarded secrecy, and even up until a month ago, no disposition to remove the veil was apparent, or seemed even to have been considered. Throughout the period named a few of our more prominent manufacturers were groping their way with the assistance of such knowledge of methods, devices and equipment details as may have been their good portion to secure, and that their efforts and labors have not been in vain is now amply borne out, thanks, more than anything, to their native intuition and mechanical genius.

Necessity knows no law, and, after all, has little respect for secrecy, even of the official type. Ottawa, as in many other directions in recent times, failed to realize as it should that this shell manufacturing business was the "Nation's Business," and, in the attempt to hush and lull the Canadian public and Canadian industrial enterprise into unconcern relative to shell production, she unwittingly—we hope indeliberately—created a situation as regards our engineering and metal working plants that time even may not now provide the needful compensation.

The demand for ammunition ad. lib. was public knowledge long before public participation in providing it was deemed necessary. Whether the placing of contracts through our Shell Committee or extending the scope and freedom of that body in its work was too unspectacular as compared with raising volunteer contingents for overseas service, or whether due to a desire on the part of Ottawa officialdom to appropriate and concentrate credit in a limited personality, the fact remains that to-day our engineering workshops and metal working factories are not equipped as they should and would otherwise have been to handle this shell manufacturing business as becomes our captains of industry, their staffs and employees.

However much or however little has already been done to develop shell production in our Dominion, it is quite apparent that a great deal more is required, even neglecting the leeway which should but never may be made up. The meantime greatest trouble connected with Canada's shell industry belongs to the supply of shell forgings, it being a matter of more or less common knowledge that while the capacity of our machine shops is the equivalent of some forty thousand finished 18-pounder shrapnel shells per day, our forging plants in existence are able to meet this rather over half-way only, or to the extent of 23,000 forgings per day.

One things appears certain, our manufacturers have not been assured as they might have been of the prodigality of shell orders available, else more of them would have gripped this shell business at the billet instead of at the forging end. In addition, with reference to the machining processes only, there has been much hesitancy displayed towards rearranging or installing new equipment and attachments.

The engineering and metal working industries of Great Britain and France have been so organized and developed during the past nine months that the output of munitions of war for March of this year as compared wih last September has increased twenty and thirty times respectively, and is still rising. It is pertinent to ask at this stage of the game if all of our manufacturing concerns who are not now producing shells but who want to bear a part in the work, have been made fully cognisant of the prodigality of the situation and been encouraged if not bidden to jump in?

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 00
Copper, crucible	13 00	13 00
Copper, unch-bled, heavy	12 50	12 50
Copper, wire, unch-bled	12 50	12 50
No. 1 machine compos'n	10 00	10 50
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	10 50	10 50
No. 1 brass turnings	8 00	8 00
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	8 00	8 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect May 14, 1915:

	Buttweld Black	Gal.	Lapweld Black	Gal.
Standard				
¼, ⅜ in.	63	44	....	....
½ in.	68	53	....	....
¾ to 1½ in.	73	58	....	....
2 in.	73	58	69	54
2½ to 4 in.	73	58	72	57
4½, 5, 6 in.	....	....	70	56
7, 8, 10 in.	....	....	67	53
X Strong P. E.				
¼, ⅜ in.	56	44	....	....
½ in.	63	51	....	....
¾ to 1½ in.	67	55	....	....
2, 2½, 3 in.	68	56	....	....
2 in.	....	....	63	52
2½ to 4 in.	....	....	63	55
4½, 5, 6 in.	....	....	66	55
7, 8 in.	....	....	59	47
XX Strong P. E.				
½ to 2 in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	57	38	....	....
½ in.	62	47	....	....
¾ to 1½ in.	67	52	....	....
2 in.	67	52	63	48
2½, 3 in.	67	52	66	51
3½, 4 in.	....	....	66	51
4½, 5, 6 in.	....	....	63	49
7, 8 in.	....	....	60	46

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 50	20 75
Castings, copper	20 00	20 50
Tin.	45 00	42 00
Spelter	17 00	17 00
Lead	5 60	5 75
Antimony	35 00	40 00
Aluminum	23 50	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.75
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.73
Linseed oil, raw, single bbls.	0.82
Linseed oil, boiled, single bbls.	0.85
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.15½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. (galvanized)	4.60	4.60
Queen's Head, 28 B.W.G.	4.75	4.75
Fleur-de-Lis, 28 B.W.G.	4.45	4.45
Gorbal's Best, No. 28	4.75	4.75
Viking metal, No. 28	4.35	4.35

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 17, 1915.—General market conditions throughout the province are in perhaps a little more encouraging condition than they have been for some time past. This is due more or less directly to the making of various lines of war supplies, principally ammunition. The distribution of several orders for lyddite shells, of a heavier variety than that generally manufactured here, has lent not a little encouragement to steel manufacturers. Machine tool men are also very busy filling orders accepted earlier in the year. The foundry trade is still very quiet and pig iron markets are in consequence very dull. Metals are exceedingly active and more so as the demands for munitions of war are continually increasing. It would thus appear that business is improving, and, taken together with the fact that water communication with this port is fully established for the season, the outlook is much better than has been the case of late.

Steel Trade.

The tremendous and unforeseen demand for shells in Canada has been the medium through which many steel companies have been able to increase their business. The 4.5 inch lyddite shell is quite a weight in itself and when thousands of these shells are being manufactured it runs into a big tonnage. Then again, base plates, steel discs, etc., are all consuming large quantities of steel.

Another feature that has been attracting the attention of the sales departments of the various steel corporations is the present opportunity to develop foreign trade. The Algoma Steel Corporation have succeeded in placing a considerable tonnage in the United States and some in the South African colonies. It appears that the German foreign trade in steel ran up to over 20,000,000 tons annually. This supply has, of course, been cut off indefinitely. The demand has naturally shrunk materially but there still remains a large proportion to be looked after. To Canada and the United States will fall the duty of supplying this demand.

At present the high ocean freight rates absolutely prohibit the export of steel. In Australia to-day large tonnage could be sold if there was a reasonable freight rate prevailing. It remains, however, to be seen just what means will be taken to place Canadian steel in foreign countries. The demand is there, and Canadian steel is known to be of the best quality.

Tool steel is in good demand but building sections are rather inclined to be quiet.

Pig Iron.

Pig iron is strangely dull. No trade at all is reported. Foundries are generally working on short time or are closed down. The result is that business is very poor indeed, and no price changes are reported. There is practically no foreign trade at all moving.

Machine Tools.

The rather unprecedented situation in machine tools still exists. Very few changes occur from week to week, the output of most factories being booked for months. However, a most lively business is being developed in rebuilt tools for immediate and early delivery. Attachments for use in tooling up standard machines are also commanding much attention. Banding presses, nosing presses, and furnaces are in great demand, and many firms are building these in their shops to sell. These machines have been designed, developed and tested for use, in the shops which build them, and many excellent designs are available; some being pneumatic and some hydraulic presses. Keen competition in the sale of these machines is evidenced by the various agents representing the manufacturers.

The supply business is excellent also. Shops are now running full time, and some of them to the extent of twenty-four hours a day. This creates a healthy demand for supplies. Hydraulic presses for making forgings have been installed in many plants recently, thus the forging capacity of Canadian companies is rapidly increasing and will soon be up to the machining capacity which to-day is greatly in excess of the other. As the forging capacity increases the supply business will benefit.

Metals.

The lively demand for metals for use in the manufacture of war munitions still continues. Copper prices are a little stronger and the tendency is to increase the prices still more. Tin is a little easier and has dropped in price a little. Spelter is in good demand and the price has gone up some. Lead prices are firm but unaltered. Antimony is selling well. The supply available is not great but seems to be sufficient for immediate needs. The demand, though, is largely in excess of that which was anticipated. Aluminum is very quiet. War demands have made business in all metals exceptionally good, the improvement has been especially noticeable of late.

Toronto, Ont., May 18, 1915.—Industrial conditions on the whole are showing some improvement, although the increased activity is principally accounted for by the war orders. Makers of leathers goods are very busy a large order for boots having been distributed among factories in Ontario by the Government. Further orders are also expected to be placed for boots by the Russian Government. Crop conditions continue favorable and there is an optimistic spirit in business circles on this account. A good crop will have a beneficial effect on trade, in addition, the money coming into the country on account of war orders will considerably improve conditions generally. The loss of the Lusitania has had the effect of increasing marine insurance rates and ocean freights are very high due to the shortage of tonnage.

Steel Market

Conditions in the steel trade are much the same as last week. The demand for shell forgings is on the increase and steps are being take to cope with the situation by the installation of more forging presses. There is also an increasing demand for round steel bars for high explosive shells. Generally speaking the mills are working to capacity on steel for shells but quiet as regards ordinary business with the exception of the Algoma Steel Co. where the rail mill is in active operation. It is announced that the Dominion Steel Corporation has recently received a large order for shell forgings.

The building trade is not showing any substantial inmprovement and there is little inquiry for structural shapes. There has been a somewhat better demand lately for cast iron and steel pipe for water works extensions but the total tonnage will probably not be as heavy as last year. Prices on bars, plates and shapes are firm but unchanged.

An advance in prices of wrought iron pipe is announced due to increase in cost of raw materials. The recent advance in the States has also strengthened the market. The new discounts are 1 per cent. lower for block pipe ranging from 2 to 3 per cent. lower for galvanized pipe. Complete basing discounts are given in the selected market quotations.

Conditions in steel trade in the States are improving, an important factor being the large orders for steel products for foreign account, including munitions.

Pig Iron

The trade is very dull and indications point to a continuance of the present conditions for some time to come. Until the industrial situation improves along more normal lines there will not be much demand for pig iron.

Machine Tools

The difficulty of obtaining satisfactory deliveries of tools for making shells continues to cause great inconvenience to dealers and also to concerns contemplating going into the shell business. The situation has caused an unusual demand for second-hand tools and all suitable machines are being snapped up. The number of firms making shells is increasing and the demand for machine tools and tooling fixtures is therefore keeping up. More orders for high explosive shells will be distributed in the near future, and this which will create a further demand for lathes and drills. Ordinary business is still dull, dealers concentrating their energies almost entirely on enquiries for shell machinery.

Supplies

The supply business continues brisk and prices are holding firm. The only price change to note is in linseed oil which has advanced 2c and is now quoted at 82c for raw oil.

Scrap Metals

The market is active for copper and brass scrap, and quotations are very firm. Scrap iron and steel are dull and market quiet. Quotations are unchanged.

Metals

The general situation in the metal markets is practically the same as last week. Copper, antimony and spelter are strong, but tin is weak, and lead unchanged. Locally there is a good demand for copper, lead and antimony for munitions, but ordinary business is quiet. Spelter continues very scarce and quotations nominal.

Tin.—The tin market is dull and easy, and the spot market is weaker on account of further supplies being available. Spot demand is dull. The market

has declined 3c and tin is quoted locally at 42c per pound.

Copper,—The market is quiet but strong and quotations unchanged. The New York Market is unsettled pending a reply to the American Government's note to Germany. Export inquiry continues good with fair domestic inquirey. Lake Copper is quoted locally at 21c per pound.

Spelter,—The market is very strong for both prompt and future deliveries. There is at present the greatest scarcity of spelter that has ever been experienced, and it is reflected not only in the advance of prices of prompt spelter but also in the continued rise of futures. Spelter has advanced 1c and quotations are normal at 17c per pound.

Antimony,—The market is dull but strong. The demand for antimony for munitions continues exceedingly large and higher prices are likely on account of the scarcity of this metal. Quotations are firm but normal at 40c per pound.

Lead,—The market is quiet but firm. There is a heavy demand for lead but the producers are able to meet it. The production of lead this year is believed to be greater than in 1914 when all records were broken. Quotations are unchanged at 5¾c per pound.

Aluminium,—The consuming demand is good, and market firm. Quotations are unchanged at 23½c per pound.

WAR REVENUE DATA.

THE operation of the new war taxes is proving most satisfactory. The declines in revenue which were so marked a few months ago have been completely arrested while the present receipts are substantially on a parity or in excess of the corresponding period of last year.

In September, 1914, the loss of revenue was over $5,000,000, in October $3,500,000, in November $4,000,000, in December nearly $4,000,000, in January nearly $2,000,000. In the six months from the outbreak of the war to the end of January the total loss in the revenue over the corresponding period of the previous year was $18,669,317.81.

Dominion Revenue.

The war budget came into effect on Feb. 12, since which date the revenues of the Dominion, although in the war period, have maintained a parity with those of the ante bellum months of the preceding year. For the months of February, March, April and the first ten days of May, the revenue of the Dominion has been $37,058,611.22, as compared with $37,332,310.92 for the corresponding period of the previous year.

The revenue for the fiscal year which ended on March 31 last, was estimated by the Minister of Finance upon the basis of the then existing tariff at $130,000,000. By reason of the increase in duties upon importations between the date of the budget speech and the end of the fiscal year the revenue will be found to be more than a million dollars in excess of the estimate.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Calgary, Alta.—The Ford Motor Co., of Ford, Ont., may build an assembling plant here.

Cobalt, Ont.—Fire damaged the Cobalt foundry on May 7, to the extent of $1,500.

Paris, Ont.—The G. W. McFarlane Engineering Co. has secured an order for shrapnel shells.

Niagara-on-the-Lake, Ont. — A mechanical filtration plant will be installed at the military camp here.

Port Arthur, Ont.—The Western Drydock and Shipbuilding Co. may manufacture farm tractors.

Sherbrooke, Que.—McKinnon, Holmes & Co. are making an extension to their plant which will be used as a machine shop.

Montreal, Que.—It is reported that the Canadian Car & Foundry Co. have received an order for two thousand steel cars from the Russian Government.

Kingston, Ont.—The Canadian Locomotive Co. will build an extension to their plant, 233 ft. long by 67 ft. wide. The building will be equipped with machinery for making shells.

St. Marys, Ont.—The by-law has been put through instructing the Clerk to issue debentures for $12,550 to provide for a new street lighting system, new gasoline. plant, etc.

Toronto, Ont.—The Local Hydro-Electric Commissioners received reports that there had been 3,000 horse-power added to the business of the system since the beginning of the year.

Hamilton, Ont.—A large ammunition factory is to be erected locally in the immediate future, according to an announcement made at the City Hall a few days ago. Further particulars are not yet available for publication.

Hamilton, Ont.—The Canadian Cartridge Co. has reached an arrangement with the city for the purchase of a site covering about two acres. The price paid is about $4,500 an acre. The company, it is understood, have another large order for shells. A building, costing $30,000, and 100 feet wide by 300 feet long, will be erected. There will also be a boiler room and machine shop. Christman & Co. have the contract.

Toronto, Ont.—The James Morrison Brass Manufacturing Co. have asked the property committee for permission to erect a cartridge factory 80 x 300 feet, two storeys in height, at 92 Paton road. This will be an extension to the present factory and is necessary so that they may manufacture a large quantity of M. M. rifle cartridges.

General Industrial

McLeod, Alta. — The McLeod Flour Mills Co. will build a mill here.

Ridgetown, Ont. — The Ridgetown Flour Mills, which were recently destroyed by fire, will be rebuilt.

Three Rivers, Que.—A company has been organized here to establish a brick plant.

Port Arthur, Ont.—Mr. Cunningham, manager of the National Elevator, which was recently completely destroyed by fire, has stated that the elevator would be rebuilt as soon as the insurance is adjusted.

Vancouver, B.C.—H. F. Beers, of San Francisco, Cal., general manager of construction for the Sheel Company, an oil-refining concern, stated recently that he was here to look over the site for an oil refinery which the company will build in this vicinity.

Walkerville, Ont.—The Williamson Construction Co., of Walkerville, has broken ground for a new plant to be constructed for Hartwell Brothers Co., in Walkerville. The concern will manufacture implement handles, such as axe and hammer handles, etc., and is a branch of the same concern which is located in Chicago. The building will be 60 x 90 feet and one storey high.

Trade Gossip

Regina, Sask.—The Provincial Legislature has under consideration a new Companies Act to supersede the two Acts now in force.

The Canadian Ice Machine Co., Toronto, have sold a 40-ton vertical "York" steam-driven ammonia compressor to the Cowan Co., Toronto.

The Canadian Ice Machine Co., Toronto, Ont., are installing a 50-ton "York" horizontal, steam-driven ammonia compressor at the Procter & Gamble Co. new soap factory at Hamilton, Ont.

Toronto, Ont.—The Canadian Kodak Co. have awarded a contract to the Canadian Ice Machine Co., Toronto, for a 200-ton vertical "York" ammonia compressor, direct-connected to a vertical, cross-compound steam engine.

The Hamilton Lock-nut & Specialty Mfg. Co. has recently been incorporated at Toronto with a capital of $500,000 to manufacture lock-nuts, screws, bolts, etc., at Hamilton, Ont. Incorporators: Melvin J. Dunham and A. N. Wells of Middletown, N. Y., also William Gibb and William Butler of Hamilton, Ont.

E. L. Crabtree, manager of the Dominion Machinery Co., Toronto, who is associated with two prominent Toronto engineers, contemplates establishing a plant at Oshawa, Ont., for making shells and automobile parts. The new concern will be known as the Dominion Metal Products Co.

The Canadian Boomer & Boschert Press Co., Montreal, Que., has recently booked an order from the Canadian Vickers' Company, of that city, for six 350-ton hydraulic presses for forging 4.5 shells. Orders have recently been completed by the same company for the following:—Three 200-ton hydraulic piercing presses for shrapnel shells; three 150-ton hydraulic drawing presses for shrapnel shells; four 150-ton hydraulic disc presses; two 60-ton hydraulic pointing presses.

The Hamilton Lock-Nut & Specialty Co., which was recently incorporated, expects to start operations early in June in a building which has been rented at Hamilton, Ont. The following directors have been appointed:—M. J. Dunham, A. N. Wells, W. J. Sutterby, W. H. C. Stroud, J. T. Stroud, O. W. Gibb, Wm. Butler, J. E. Davies, J. W. Anderson. The officers elected were as follows:—M. J. Dunham, president; J. T. Stroud, vice-president and secretary-treasurer; C. V. Langs, attorney for the company.

Big Shell Contract.—C. S. Martin, general superintendent of the Dominion Steel Corporation, on Saturday last received telegraphic notice to the effect that the Shell Committee at Montreal had awarded them a contract for the manufacture at Sydney of 1,500,000 shell forgings. This is in addition to a

600,000 shell order received some time ago, part of which has already been delivered.

The Canadian Allis-Chalmers, Ltd., Toronto have been awarded the contract for pumps for the Gage Ave. sewage disposal plant by the Hamilton Board of Control.

The Canada Wire & Cable Co., and Maloney Electric Co. of Canada, Ltd., have removed from 401 Lake of the Woods Building, to 501 Merchants Bank Building, Montreal Que.

Dominion Steel April Output.—The Dominion Steel Corporation reports its output for April as follows:

	April, 1915. tons.	Previous year. tons.
Pig iron	23,130	20,861
Steel ingots	25,343	26,397
Rails	1,633	13,712
Rods	6,512	3,021
Bars	924	2,203
Wire & wire prod'ts	3,254	2,380
Coal output	357,335	410,382

Berlin, Ont.—Shoe manufacturers of Berlin, Waterloo, Guelph, Brampton, Tilsonburg, Hamilton, Galt and other Ontario towns met here on May 4, for the purpose of making arrangements to handle a large order of shoes for the British army. It is understood that, providing it is guaranteed that the boots will be turned out according to specifications, 2,000,000 pairs will be manufactured at an estimated cost of $8,000,000. This will mean that all the shoe industries in western Ontario will be expected to turn out 10,000 pairs of shoes a day for a period of seven months.

New Pulp Wood Process.—What promises to revolutionize the pulp wood industry and have an important bearing on the paper trade is disclosed by H. J. Lyons, vice-president of the Canada & Gulf Terminal Railway, which is controlled by M. J. O'Brien. It is claimed that a new process, worked out in McGill University laboratories at Montreal, and which is to be freely available to any pulp wood producer, will result in reducing the weight of a cord of wood to about 2,200 pounds, thus making pulp wood available, which was previously unremunerative because of remoteness from paper mills and consequent high freight rates. The wood will be prepared in chipped form and dried and baled. A saving in weight of about 2,300 pounds, or nearly 50 per cent., is claimed.

Manitoba Branch C.M.A.—W. R. Ingram was elected chairman of the Manitoba branch of the Canadian Manufacturers' Association at its annual meeting on May 13. For vice-chairman, D. J. Dyson was elected, and W. J. Bulman was nominated as Manitoba vice-president of the Association, the nomination to be acted upon at the annual convention of the Association in Toronto, which begins June 8. The following executive council was chosen: W. S. Fallis, W. A. Matheson, T. R. Deacon, D. E. Sprague and L. A. Race, Brandon. The new executive committee consists of L. C. McIntyre, D. E. Sprague, T. R. Deacon, W. S. Fallis, H. W. Billing, John Brockest, G. F. Campbell, Jas. M. Carruthers, M. F. Christie, E. A. Mott, W. L. Helliwell, W. T. Kennedy, Thos. Boyd, F. J. Baker and N. W. Warren.

Municipal

Cartierville, Que.,—The Council contemplate installing a filtration plant.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

British.—Lieut. Johnston and A. C. Billing, Ritz Carlton Hotel, Montreal.

French—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminster, London.

Russian — Messrs. S. Ruperti and Aiekieff, care Military Attache, Russian Embassy, Washington, D.C.

Unionville, Ont.—The purchase of a gasoline fire-engine is under consideration by the council.

Port Colborne, Ont.—The good roads by-law was carried on May 17, the voting being 166 for, and 33 against.

Toronto, Ont.—The Board of Control has decided to advertise for tenders for four cars for the Lansdowne avenue car line.

Chatham, Ont.—The municipal lighting and power plant may be sold when the hydro system has been completely installed.

Vancouver, B.C.—Mayor Taylor announces that he will cause to be brought down to the council money by-laws for creating additional works, and he is confident the taxpayers will vote in favor of them. They will amount to $700,000 or $750,000.

Kamsack, Sask.—An expenditure of $35,000 on water mains and sewers is contemplated. A by-law will be voted on in the near future.

Hamilton, Ont.—The Board of Control has under consideration a proposal from a company to establish a factory here. No details are available at present.

Hull, Que.—Extensions to the waterworks system to cost $200,000 are contemplated. An eight million gallon turbine pump and motor will be installed.

Chatham, Ont.—The construction of a system of intercepting sewers and two disposal plants is proposed for Chatham by plans prepared by City Engineer Adams. The estimated cost of the work is $120,473, which includes the cost of the pumping station but not the disposal plants. The council will in all probability deal with the scheme this year.

Mimico, Ont.—A method of supplying Mimico with water was practically agreed upon at a special meeting of the Village Council on May 17, when plans and rates were submitted by the New Toronto Council. The proposal is to purchase the water from New Toronto, to construct the mains under the local improvement system and to install a meter in each consumer's residence. It is estimated that the village will ultimately require about 50,000 gallons per day.

Tenders

Peterborough, Ont.—Tenders for the supply and installation of a complete pumping unit will be received until May 31. Plans and specifications may be obtained from S. R. Armstrong, secretary of the Peterborough Utilities Commission.

Toronto, Ont.—Tenders will be received up to Tuesday, May 25, 1915, for a five million gallon pump, driven by 3-phase induction motor, for the Riverdale pumping station. Tenders must be addressed to the Chairman, Board of Control, City Hall, Toronto.

London, Ont.—Tenders will be received up to June 2 for a modern combination chemical and hose car, equipped with one 40-gallon tank, and having capacity for carrying 1,200 feet of 2½-inch hose. Full information will be furnished by Fire Chief John Aitken.

Ottawa, Ont.—Tenders will be received up to July 1, 1915, for the manufacture, supply and erection of a 30-ton steam wharf crane, of the derricking jib type, for Halifax, N.S., dockyard. The specifications and conditions of contract may be seen at the office of the consulting naval engineer, Ottawa.

Winnipeg, Man.—Tenders addressed to the Chairman, Board of Control, will be received up to Saturday, June 5, 1915, for the manufacture, delivery and erection in the generating station at Point du Bois of one 150 k.w. motor-generator exciter set. Instructions to bidders, specifications and form of tender may be obtained at the office of the City Light and Power Department, 54 King street, Winnipeg.

Wallaceburgh, Ont.—Tenders will be received by the town clerk until Tuesday, June 1, 1915, for the following works: Contract "A-1"—laying water mains; "A-2"—laying sewers; "O"—Laying sewer force mains; "P"—constructing sewage pumping stations; "T"—constructing electric transmission line. Plans and specifications may be seen at the office of Chipman & Power, engineers, Mail Building, Toronto, or at the resident engineer's office, Wallaceburg.

Personal

Walter Moberly, railway engineer, died at Vancouver, B.C., on May 14, at the age of 83 years.

Joseph Rielle, civil engineer, died at Montreal on May 9, aged 81 years. Mr. Rielle was born at LaPrairie, Que.

George Elliott Minorgan, son of George Minorgan, proprietor of the Phoenix Foundry at Beaverton, Ont., was killed in action at Langemarck.

Lieut. Eric B. Schrieber of the 2nd Artillery Brigade, and until recently representative of Mussens, Ltd., at Quebec city, has died of wounds received in action.

W. J. Brick, formerly of the Campbell & Brick Heating Co., Winnipeg, has taken over the management of the Canadian Motor Co., succeeding A. T. Lane, who previously held the post.

Claude A. Bulkeley has been appointed chief consulting engineer with the Canadian Domestic Engineering Co., Montreal. Until recently Mr. Bulkeley was a consulting mechanical and electrical engineer in New York.

Charles Rogers, head of the firm of Charles Rogers & Sons, furniture manufacturers, died suddenly of heart failure on May 9, at his home, 25 Lonsdale road, Toronto. Born in Glasgow, Scotland, 71 years ago, deceased had resided in Toronto for the past 65 years.

Thomas Hilliard of St. Catharines, Ont., has been appointed secretary of the Purchasing Commission of which Hon. A. E. Kemp is chairman. He is an electrical engineer and has been sales manager for the Canadian General Electric Co., and later for the Crocker-Wheeler Electric Co.

Lieut. J. B. Neale of the Royal Grenadiers, who went to the front with the first Canadian expeditionary force, has arrived in Toronto, having been invalided home and on leave of absence. At the time he volunteered for the front he was manager of the Electrical Products Co. of Canada, Toronto.

Marine

Steam Barge Order.—In a welter of war orders large contracts based upon a peaceful expansion in domestic commerce are, unfortunately, rare enough to claim distinction at the moment. The Collingwood Shipbuilding Co., Collingwood, has received an order for a steam barge from the Imperial Oil Co. of Sarnia, and the announcement will be received with unusual satisfaction in Collingwood, especially as there is said to be a promise of a second contract later on. The Imperial Oil Co. has hitherto had its boats built on the Clyde, but in view of conditions existing there, it was decided to give local industries the preference. The barge will cost $200,000, and delivery will be made in March next. The boat will be used largely on the St. Lawrence route, and if a second craft is ordered it will be placed upon the Pacific Coast.

New Incorporations

The Western Canada Power Co. has increased its capital from $5,000,000 to $10,000,000.

The Kawneer Manufacturing Co. have increased their capital stock from $100,000 to $200,000.

Fraser, Brace & Co. have had their charter extended to permit of water and electrical power development.

The Federal Rubber Co. has been granted an Ontario Provincial license to carry on business in that province, with a capital not exceeding $10,000.

The Dominion Road Machinery Co. has been incorporated, with a capital of $300,000, to manufacture road and agricultural machinery at Goderich, Ont.

The Columbia Handle & Lumber Co., of London, Ont., has been reorganized with a capital of $100,000, and will continue to make the same products as previously.

The Lion Polish Co. has been incorporated at Toronto, with a capital of $40,000, to manufacture shoe polishes. Head office at Toronto. Incorporators—Oscar H. King and M. P. Van der Voort.

The Manitoba Universal Farm Tractor Co., Ltd., has been incorporated at Ottawa, with a capital of $50,000, to make tractors and engines, etc., at Winnipeg, Man. Incorporators—William Bryden, Herbert Irwin Call and Charles McPherson, all of Winnipeg.

Wood-Working

Victoria, B. C.—The Weeks-Dunell Cedar Co. propose building a shingle mill and wharf on Baynes Sound.

Rodney, Ont.—The Rodney Woodenware Co. plant was destroyed by fire on May 10. The loss is estimated at $6,000.

Three Rivers, Que.—The Gres Falls Co. saw mill was destroyed by fire on May 14. The loss is estimated at about $100,000.

Mount Brydges, Ont.—The Wallace Sawmill Co. will probably rebuild their plant, which was destroyed by fire recently.

Three Rivers, Que.—The saw mill of the Gres Falls Co. was practically destroyed by fire on May 14. The mill was in readiness for the season's sawing, and its destruction at this time of the year will be a severe loss to the company.

Catalogues

Kerr Turbine Co., Wellsville, N. Y., has just issued bulletin No. 52 describing and illustrating "Economy" steam-turbine-driven pumps for water supply, boiler feeding, fire service, circulating condenser water, circulating water in heating systems, draining mines, etc.

Furnaces.—The Monarch Engineering & Manufacturing Co., Baltimore, Md., are distributing a bulletin devoted to melting and refining furnaces for treating various metals. The different types of furnace are illustrated and accompanied by a brief description covering the principal features of each with sizes and capacities. Other equipment described includes core ovens, blowers and fuel burners.

Speed Counter.—The Canadian Hart Wheels Co., Hamilton, Ont., are distributing a bulletin dealing with the "Veeder" straight reading speed counter. Two types are described and illustrated, viz., clutch speed and direct speed counter.

The Holyoke Machine Co., Worcester, Mass., are distributing a leaflet giving particulars of the Lombard friction clutch. The chief item of interest is a table giving the principal dimensions and

a half cross-section to use in conjunction with the table.

Feed Water Regulators made by the Chaplin-Fulton Mfg. Co., Pittsburgh, Pa. This catalogue describes the "Vigilant" feed water regulator and the steam specialties, including reducing valves, and pump and tank governors. The general principles covering the automatic regulation of the water supply to steam boilers are dealt with in the opening pages, followed by a complete description of the "Vigilant" feed water regulator and its operation. The construction of this regulator and its application are shown by means of a number of illustrations. The same treatment is accorded the other specialties. Copies may be obtained from the Canadian representatives, The P. E. Cleaton Co., Montreal, Que.

Mechanical Stokers. — Bulletin No. F106. issued by the Hare Engineering Co., Ltd., Toronto, deals very fully with the "Fulton" water-cooled mechanical stoker. The principal features embodied in the design of the stoker are described in detail and the advantages claimed for this particular type are referred to at length. The illustrations include exterior views of a number of installations under different types of boiler, also longitudinal sections showing the general arrangement of the various parts. The concluding pages show a combustion-draft curve and also contain a description of the "Theco" damper regulator. A number of testimonials from users are included.

Theory and Practice of Sherardizing is the title of a booklet written by Dr. Samuel Trood for the United States Sherardizing Co., Newcastle, Pa. The booklet contains a scientific explanation of what the sherardizing process really is, and the practical conditions under which it should be employed. A great deal of valuable information is given in this booklet on the subject and also a detailed description covering the application of this process. In addition, the advantages and disadvantages of different processes of protection of iron and steel against corrosion are discussed at length. The illustrations show different views of a sherardizing plant and a diagram entitled Rust Protection is also very instructive. Copies of this booklet may be obtained from Chambers, Ltd., Don Esplanade, Toronto, who hold the Canadian rights for this process.

Shrapnel Shell Manufacture

Shell Department of a Canadian Railroad Shop

Staff Article

The equipment of our up-to-date railroad and motive power establishments compares perhaps more than favorably with most mechanical engineering institutions in its adaptability and general readiness to extend the scope of its operations, hence small wonder is it that the illustrations and description which follow will be found to show that as regards shell production, this chosen plant is well to the front in its every feature requirement.

WHEN it was first suggested that shrapnel shells be made in Canada, there were many men whom past experience had taught us to consider as authorities in the engineering field, who thought that it would be impossible for Canadian shops to take up this line of manufacturing. Nevertheless, there were also other engineers, for whom we now have nothing but the highest praise, who were determined to investigate the proposition for themselves, and it is to these latter that we, to-day, can attribute this nation-wide industry of shell making.

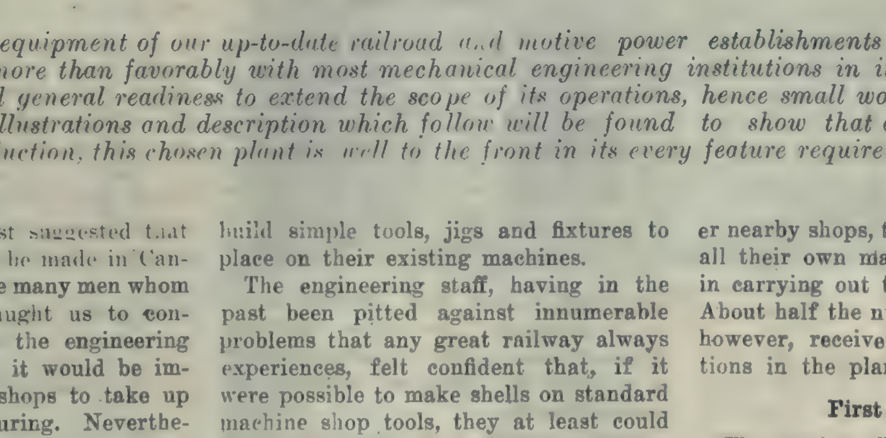
As we enter any shop engaged in the the manufacture of shells we have our interest at once keenly aroused by the many ingenious tools and fixtures that are being used, but to enter one of the shops which were among the pioneers in this business, our interest increases three-fold. In the matter of this railroad shop, now turned into an arsenal, it has to be borne in mind that here many of the fundamental problems were solved. Many of the tools, etc., now being successfully applied in shops all over the Dominion had their origin here also, facilities having been given those concerned to inspect and carry away such information and data as would enable them to build simple tools, jigs and fixtures to place on their existing machines.

The engineering staff, having in the past been pitted against innumerable problems that any great railway always experiences, felt confident that, if it were possible to make shells on standard machine shop tools, they at least could do it. Spurred on by patriotic motives, they went right into the problem, and, to-day as a result, have evolved one of the most extensive shell manufacturing institutions in our Dominion.

It has been the practice of the plant, as the output increased to have many of the roughing operations done in smaller nearby shops, they themselves utilizing all their own machines and skilled men in carrying out the finishing operations. About half the number of shells finished, however, receive their roughing operations in the plant.

First Operations.

The cutting-off of the ragged ends of those shells roughed by the company, is done on an ordinary cutting-off machine not situated in the shell shop but in the main machine shop of the plant. The machine in times of peace is used for cutting off crank pins, wrist pins, etc. Although a very substantial and serviceable machine, and still doing excellent work, it shows signs of having done its share of hard duty and long since it seems to have parted company with its name plate. The shell is placed on the machine and its length marked off with the special scratch awl shown in Fig. 1. A portion of the shell near the outer end is "chalked," and the awl is placed in the shell as shown in Fig. 1, the proper distance from the inside bottom of the shell being marked on the outside. The shell is then chucked in a three-jaw universal chuck and a parting tool fed into the work. Thus, the first roughing operation is accomplished. Test-



CONSTRUCTIONAL FEATURES AND DIMENSIONS OF BRITISH 18-POUNDER SHRAPNEL SHELL.

ing with the gauge shown in Fig. 2, follows. The point of reference for this first cut was the bottom of the powder pocket, and in the finishing of the back ends of the shells, here the point of ref-

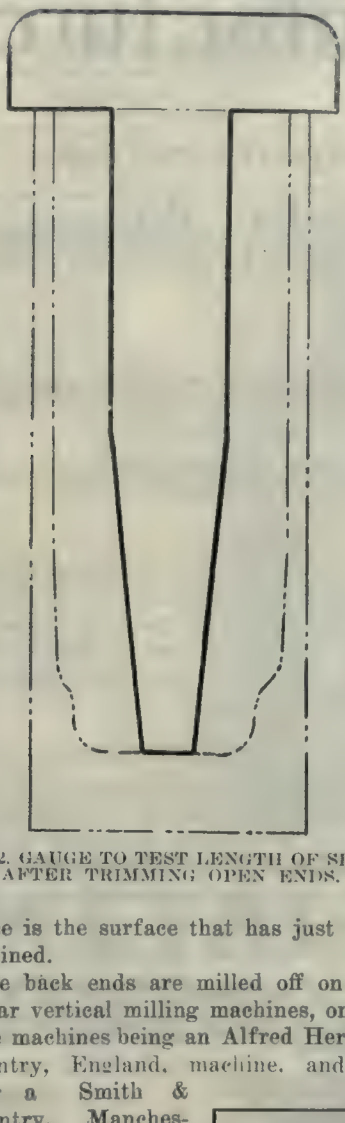
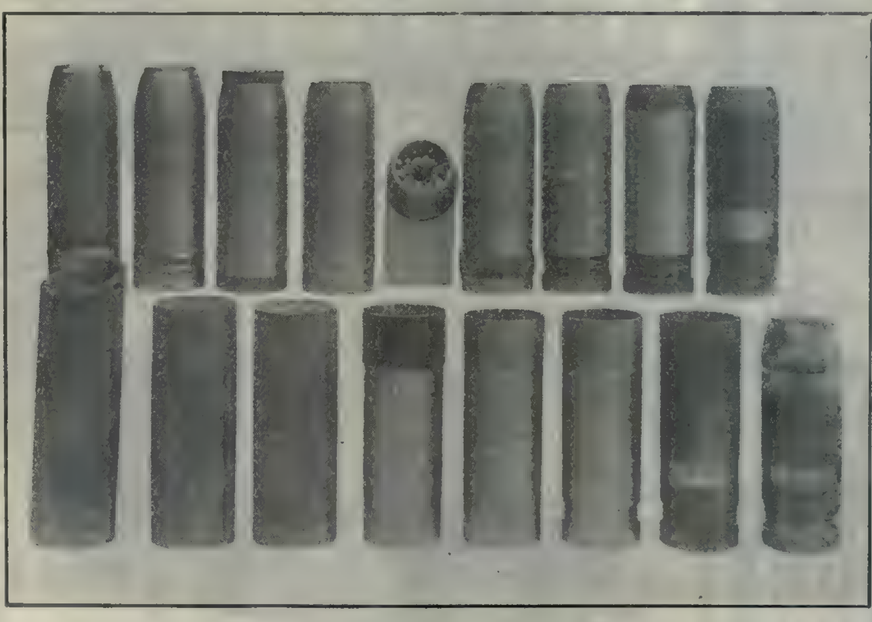


FIG. 2. GAUGE TO TEST LENGTH OF SHELL AFTER TRIMMING OPEN ENDS.

erence is the surface that has just been machined.

The back ends are milled off on two similar vertical milling machines, one of these machines being an Alfred Herbert, Coventry, England, machine, and the other a Smith & Coventry, Manchester, England. On the table of each, a similar jig, which accommodates three shells, is placed. The shells are pushed into the jig, open ends first, until the faced open ends come against a a stop. Set screws clamp the shells tightly in the jig. The table is moved in to a stop and then traversed by power, causing the solid milling cutter 2½ inches in diameter to pass over the face of the shell in about two minutes. The cutting is practically continuous, as finished shells can be removed and new ones put in place while the machine is cutting. Soda water cutting lubricant is used in the cutter, the supply being obtained from a belt-driven centrifugal pump. As will be seen in Fig. 3, the jig is extremely simple and the production of the machines is good. Fig. 3 shows the Alfred Herbert machine, the Smith & Coventry machine being very similar in design. After these two operations are completed the shells are carried over to the shell shop proper on trucks running on the standard gauge industrial tracks installed about the shops and adjacent yards.



SHELLS IN PROCESS FROM THE FORGING TO THE PRODUCT AS COMPLETED IN CANADA.

Rough Turning Operation.

The shells pass on to the rough turning lathes immediately that they enter the shell shop proper. The company had fitted up some turret lathes with more or less elaborate tooling on the turrets to take care of all the roughing operations, including the turning of the driving band groove and the finishing of the back end of the shell. However, after a more or less extensive series of experiments it was found to work out to better advantage to have each machine tooled up to accomplish one simple operation. The men become more expert and there is no elaborate system of tooling to become deranged.

Various types of machines are fitted up for the rough turning and facing of the ends of the shells. The first machine is a Gisholt turret lathe. This has a hollow spindle and to the face plate is bolted an expanding chuck, shown in Fig. 4. Fig. 5 also shows this chuck attached to the Gisholt lathe. The end of the central spindle acts as a locating stop for the shell. This stop comes in contact with the bottom of the powder pocket. Three expanding jaws grip and centre the outer end of the shell, these jaws being expanded by the tapered central rod of the chuck. This central rod goes through the hollow spindle of the machine and a handwheel is attached to the extension of the rod. The rod passes

FIG. 1. SCRATCH AWL FOR MARKING OFF LENGTH OF SHELL BEFORE TRIMMING OPEN ENDS.

through a stationary nut, and hence, when the handwheel is turned, the rod is caused to move. The inward movement of the tapered portion of the rod gives to the jaws their expanding motion, while the outward movement of the rod releases the jaws. However, to ensure the jaws always withdrawing from the work, a groove is turned in these jaws into which is inserted a little coil of spring steel wire, the ends of which have been joined to form a circle. This coil spring is extended when the jaws are expanding, and thus, when the tapered portion of the central rod removes its pressure from the under side of the jaws, these jaws are pulled from out of contact with the shell. The inner end of the shell is held securely by the closing down of the three set screws,

one of which is shown in Fig. 5. A turret tool-holder is used to carry the three tools used in this turning operation, the main turret not being used. The first tool is the roughing tool which rough turns the shell up to within two inches of the open end, where an automatic stop throws the power carriage feed out. A snap gauge is used to caliper the work. Next the turret tool post is turned and a finish turning tool is fed into the work. This tool turns the shell to finish size up for a distance of $1\frac{3}{4}$ inches, this distance being measured off with a steel scale. A limit gauge shown in Fig. 6 is used to caliper the diameter. When this has been done, the back of the shell is faced with the same tool, the tool slide being travelled across the carriage by power feed.

The final operation on this work is done with a third tool, carried in the turret tool holder. This tool merely cuts the 1-10 inch radius on the end of the shell. Soda water lubricant is used on practically all operations, each machine being equipped with a small soda water pump belt driven from the counter shaft above the lathe.

The next lathe is a Dean, Smith & Grace, Keighley, England, engine lathe,

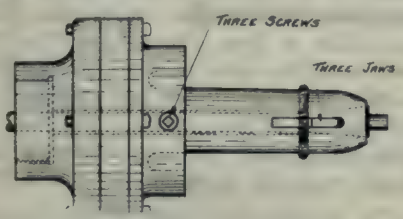


FIG. 4. EXPANDING CHUCK FOR HOLDING 18-PDR. SHELL WHILE ROUGH TURNING AND FACING.

and it is fitted with an expanding arbor or chuck similar to the Gisholt lathe just described. There are, however, four tools in the turret tool holder. Three of these four tools accomplish the same operations as have just been described. The fourth operation is done with a flat tool having its cutting edge ground at an angle to the work so as to form a taper. This tool is fed into the work near the open end of the shell and cuts away the shoulder left by the rough turning tool. The taper prepares the tool for the nosing operation which follows in due course.

Next in line is another Dean, Smith & Grace engine lathe, but it is fitted with a different design of chuck. The shell is driven on a rigid pilot bar, and the open end is centred in a three-jaw chuck with independent jaws. This chuck is not to be compared with the design just described previously, but it is designed to be fitted to solid spindle lathes. The tooling is identical to that just described in connection with the other Dean, Smith & Grace lathe.

The next machine is a John Bertram & Sons, Dundas, Ont., engine lathe. This is equipped with a solid locating bar, similar to the one just described. The

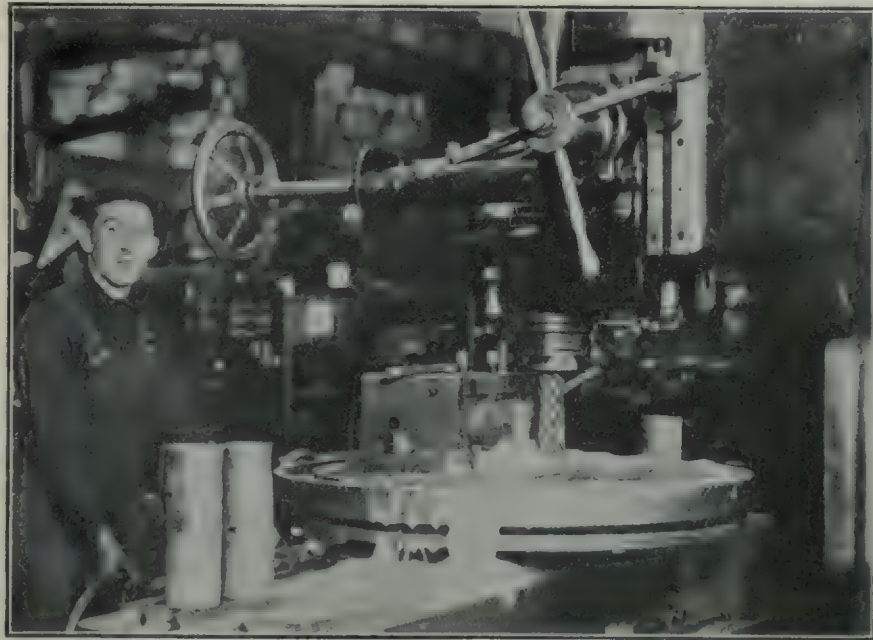


FIG. 3. MILLING BACK END OF 18-PDR. SHRAPNEL SHELLS ON A HERBERT VERTICAL MILLING MACHINE.

tapered portion of the bar which locates the shell has been fluted to increase its gripping abilities. The open end of the shell is centred in a four independent jaw chuck. The turret tool holder is similar to those previously described.

Warner & Swasey Turret Lathe.

The next machine is a Warner & Swasey turret lathe. This is completely

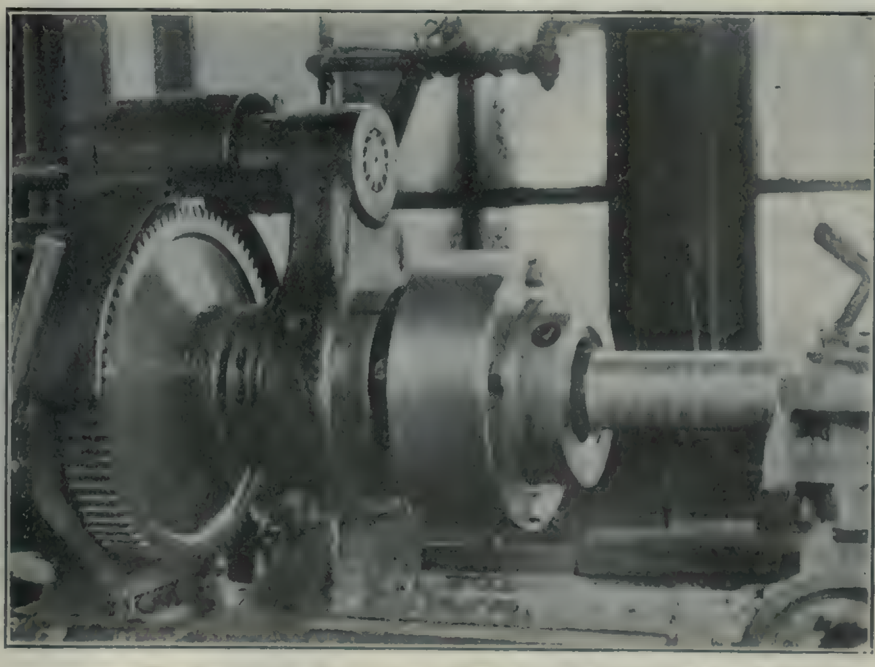


FIG. 5. ROUGH TURNING ON A GISHOLT TURRET LATHE.

tooled up to accomplish all the roughing operations. Fig. 7 shows the machine. It has been fitted up to rough turn the outside of the body, finish turn it up as far as the driving band, finish face the end of the shell, form the radius on the corner and cut the driving band groove with its waved lines. However, to make the production of the shops a maximum, the operations on single machines have been made more simple, hence the driving band recess is not turned on this lathe. However, the lathe is highly interesting and is described as follows:—

The turret is tooled up, and a turret tool holder is mounted on the cross slide. The lathe has a hollow spindle and the chuck is the same as the one fitted to the Gisholt lathe. The first operation is to face the end of the shell with a tool

carried in the turret tool holder. Then a sharp taper is turned removing the sharp corner from the end of the shell. The rough turning tool follows immediately. This tool is carried on a fixture attached to the turret. The tool is carried in the top of the fixture and the cutting end points downward. In the fixture, two follower rollers are carried. These details can be seen clearly in Fig. 7 which shows the finishing tool (similarly held) facing the front of the cut. The taper turned on the end of the shell with the finishing tool is to enable the follower rollers to easily pick up the work. The next tool is the finish turning tool which finish turns the shell up as far as the driving band. This tool is carried on the main turret also. In both these operations, the turret works up to a positive "stop." The next operation is to turn and form the radius on the back end of the shell. This tool is carried on the main turret.

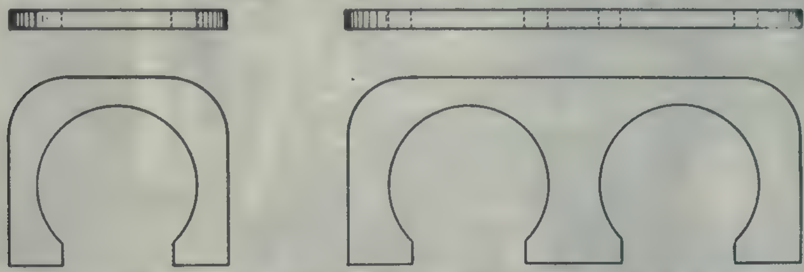


FIG. 6. GAUGES USED TO TEST SIZE OF SHELL AFTER ROUGH TURNING.

Under the present arrangement, these are the only operations carried out on this machine, however, in the earlier days of the shell work the following operations were also done on this lathe:—The turret was swung, and a revolving centre was brought up to support the back end of the shell. A flat tool roughed out and formed the driving band recess. This tool was carried in the turret tool holder on the cross slide, and left enough metal in the bottom of the groove to allow the wave lines to be formed. The turret tool post was swung around and a roller brought into register with a three-point face cam which is bolted on to the face plate of the lathe. The little tool holder is thus given a lateral motion in guides machined for it in the turret tool holder. A stiff spring keeps the roller closely pressing against the cam at all times.

The cutting edge of the tool is so ground that the wave lines are formed when the tool is fed into the work. The cross slide is fed in until a stop is reached at which point the waving tool has cut the central portion of the groove to its finished depth and has cleaned up the bottom of the groove where the former tool has previously cut the edges to finish depth. Next, the main turret is swung, and a fixture on the turret brings two little undercutting tools into position. These tools are fitted in little tool holders which travel in guides that are machined at an angle to the work. By crowding a fixture mounted on the cross slide into the back of the little tool holders, they are fed into the work at the proper angle to do the undercutting, and at the same time they cut the groove to the finish width. This completes the series of operations that can be done on the lathe with its present tooling.

The sixth and last machine used for rough turning purposes is a Warner & Swasey turret lathe. The main turret is not used. A turret tool post is mounted on the cross slide. The shell is chucked as in the case of the Warner & Swasey turret lathe just described, and the Gisholt lathe first mentioned, but two tools are carried in the turret tool holder. The first tool does the roughing cut, while the second tool faces the end of the shell, finish turns it up for a distance of 1¾ inches and forms the radius on the corner.

Cutting the Driving Band Recess.

The machining of the driving band recess is accomplished by the methods that have become more or less standard since this industry has been inaugurated in Canadian shops. Several engine lathes are tooled up to do this work. A universal chuck is fitted to each machine and on the face of this chuck is bolted a three-point face cam, made of machinery steel. A turret tool post is mounted on the cross slide, and the tool forming the wave lines is carried on the rear of the cross slide and approaches the work from the back. The shell is placed in the chuck against a stop and the outer end is supported in a revolving centre mounted on the tail-stock spindle.

The first tool to enter the work on this operation is that which roughs out the recess and cuts it to depth for a short distance on either edge, leaving sufficient metal for the wave lines to be formed in the central portion of the groove. The carriage, during this and the immediately succeeding operation is placed against a locating stop and locked there. The roughing tool is fed into the work until the cross slide works up to a stop at which point the outside cutting edges of the tool have cut the groove to depth. Then from the far side of the carriage the tool forming the wave lines is brought into the work. As the tool approaches the work, a roller registers against the three-point cam transmitting a lateral motion to the little tool holder. This tool holder is caused, by means of a spring of flat steel, to follow closely the contour of the cam. The tool slide is then drawn closer to the work and the wave forming tool enters, forming the wave lines and cleaning up the bottom of the recess. The tool is next withdrawn and the carriage released from its position.

FIG. 7. ROUGH TURNING AND CUTTING RIFLING BAND RECESS ON AN 18-PDR. SHRAPNEL SHELL IN A WARNER & SWASEY TURRET LATHE.

The turret tool holder is now swung around and the undercutting tools are brought into position to accomplish their part. The undercutting tools are held rigidly in their holders, the cross-slide is moved in against a stop and the car-

riage is released from its locked position, being moved toward the face plate against a stop. The cutting edge of the tool is so ground that it meanwhile has accomplished the undercutting. Similarly, the carriage is moved toward the tailstock of the lathe against a stop, and at the same time the little undercutting tool has accomplished the undercutting at the other edge of the groove. This completes the operations on the groove. There are three lathes similarly tooled to accomplish this operation; these are R. K. LeBlond engine lathe, and two Canada Machinery Corporation engine lathes. Limit gauges are used to determine the finished size of the groove. Small steel gauges are also used to test the width of the groove and also the undercutting.

Boring the Shells.

The large portion of the boring is done on turret lathes, but there is one MacGregor Gourlay engine lathe fitted up with some extremely interesting tools. A massive special cross slide is made to fit on the carriage. Two boring bars are fitted into this special cross slide as is seen in Fig. 9. The near boring bar carries the rough cutters for rough boring the powder pocket and the diaphragm seat. Soda water cutting lubricant is used and is carried to the cutters through a rubber hose connection from the soda water pipe. This hose carries the lubricant to the boring bar whence it passes through a duct in the bar to the tools. The tool is fed into the shell and, as the roughing depth is almost reached, a turning tool, carried on a fixture bolted to the cross slide, rough turns the outside of the shell for a short distance from the nose. This part of the shell has not as yet been machined.

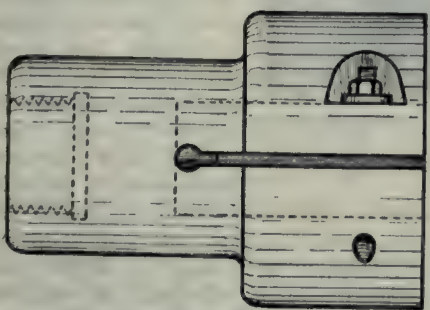


FIG. 10. CHUCK FOR BORING AND FINISHING INSIDE OF NOSE OF 18-PDR. SHELL.

Just as the carriage is about to come up against its stop, a second tool, carried on the fixture bolted to the cross slide, faces the end of the shell. The carriage travels up against its stop and the operation is completed. Two locating stops are used to locate the cross slide to centre the two boring bars. After the roughing bar has been put down in the shell, the boring bar carrying the finishing cutters is entered. The hose connection is transferred to the finishing bar, the water being meanwhile turned off at the end of the pipe main. The bar is then fed into the work and the carriage is travelled up against its stop which indicates that the tool has been fed in to the correct depth. The operation is thus completed. The tools are placed in the bars in a horizontal position and each has two cutting edges. The shell is placed in a simple chuck up against a stop and as clearly seen in Fig. 9, this chuck consists of a casting bored out to receive the shell and then split. Two studs are screwed into the one half and nuts on the other ends of the stud cause the two pieces of the split casting to close in, firmly gripping the shell. Fig. 10 shows one of the various patterns of these chucks used in the boring operations and later when finishing the inside of the nose.

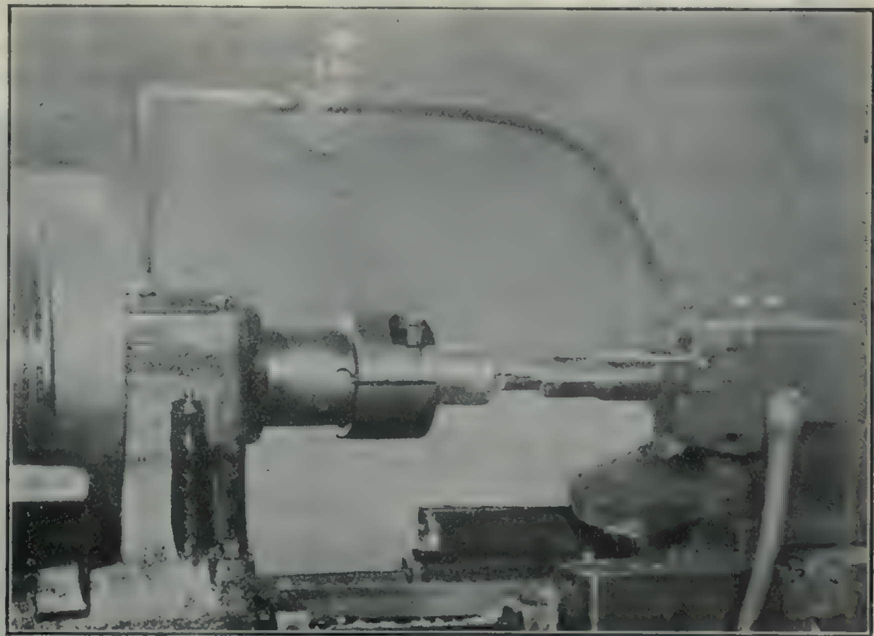


FIG. 9. BORING 18-PDR. SHRAPNEL SHELLS ON A MACGREGOR-GOURLAY ENGINE LATHE.

Another type of machine fitted up to do this work is a Lodge & Shipley turret lathe. This lathe is equipped with a chuck similar to that shown in Fig. 10, as will be seen by referring to Fig. 11. The tooling is entirely on the turret. There are two bars and these are equipped in a similar manner to those just described in connection with the MacGregor-Gourlay lathe. In the chuck,

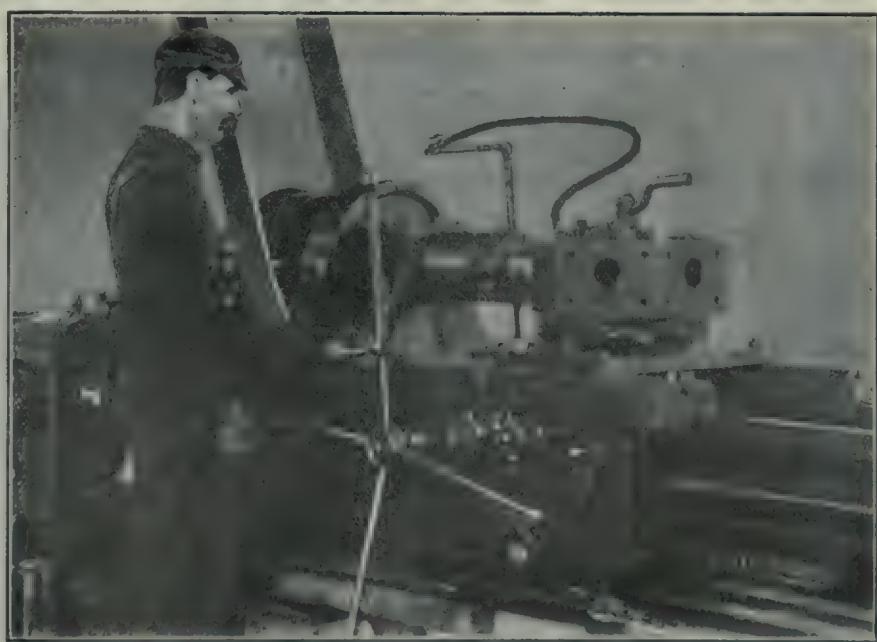


FIG. 11. BORING 18-PDR. SHRAPNEL SHELLS ON A LODGE & SHIPLEY TURRET LATHE.

however, a set screw has been placed to grip the shell more firmly. Water is also supplied to the cutters by a length of rubber hose as in the case described previously. Other than the fact that the tools are on the turret, the tooling on the two machines is identical.

It will be noted that in the case of the Gisholt lathe rough turning, there was no tool on the turret tool holder to rough turn and form the taper on the nose. This operation is done on a Warner & Swasey turret lathe tooled up for boring. The operations just described constitute the roughing operations.

Test Gauges.

A large number of shells are machined in adjacent shops up to this point, and here enter the shop and pass a rigid inspection. The size and form of the powder pocket is tested with a limit plug gauge turned to the proper profile of the powder pocket, while a similar limit plug gauge is used to test the diaphragm seat. The depth of the disc seat above the bottom of the powder pocket is tested, also the thickness of metal in the bottom of the shell, and also the over-all length. Limit gauges are used to test the diameter of the recess, also the diameter over the wave lines. Also the finished diameter of the back of the shell is tested. The gauges used, are all standard, made from the sample set supplied by the Shell Committee. It has been found that in practical manufacturing the limits allowed in size are far more liberal than the limits allowed in weight, and the manufacturer finds that the close regulation of weight rather controls the limits in size. Thus experience teaches him that his limit gauges must be made to allow of a smaller variation than the official drawings. The shells received from the outside shops having undergone the same rigid inspection as the others, all pass on to the heat treating department.

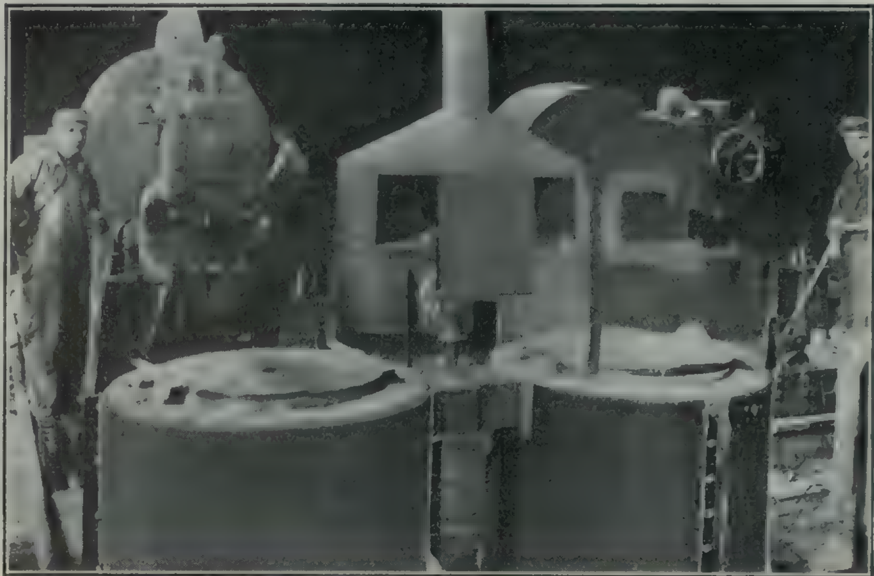


FIG. 12. TWIN LEAD POTS IN CENTRE BACKGROUND. C.M.C. AND BERTRAM PUNCHES, TO RIGHT AND LEFT RESPECTIVELY, UTILIZED AS NOSING PRESSES. ANNEALING FURNACES IN FOREGROUND.

Heat Treating and Nosing.

Two oil furnaces and two oil quenching tanks are used in connection with the hardening. The furnaces and tanks were made in the works. The former are each equipped with Bristol pyrometers. Twenty-four shells are placed in each furnace at a time and are allowed to remain there for thirty minutes at a temperature of 1,550 degs. F. They are then taken out and placed in baskets made from small flat bars of wrought iron and steel, being afterwards lifted in an air hoist and carried over into the tanks of seal oil and quenched. In the bottom of the tanks cold water coils are placed, and the circirculation of the cold water in these pipes tends to absorb the heat from the seal oil and keep it in the neighborhood of 60 degs. F. When thoroughly quenched, the shells are hoisted out of the oil tanks in the baskets and thoroughly washed in hot soda water. They then pass on to one of the six annealing furnaces which takes care of

FIG. 13. HARDENING FURNACES AND OIL-QUENCHING TANKS IN REAR. ANNEALING FURNACES IN THE RIGHT FOREGROUND, AND SAND BLAST APPARATUS IN THE LEFT FOREGROUND.

eight shells in a batch or service lot.

The shells in these annealing furnaces are heated up to a temperature of 800 degs. F., and kept there at that temperature for half an hour. Bristol pyrometers are installed to record the temperatures in the muffles of the furnaces. All of the six are oil type and were built in the works. The shells are allowed to cool in the air, and are then taken to the nosing presses. The noses of the shells are placed in a lead pot and heated to 1,400 degs. F., previous to being closed in. The lead is kept hot by means of an oil furnace, which was also built in the works. Two lead pots are placed beside each other, the heat and gases being carried away in pipes. The top of the molten lead is covered with charcoal for a triple reason — to prevent excessive radiation of heat from, and oxidation of, the metal, and to prevent the lead from adhering to the steel shell. Projecting out of the lead are rods over which the shells are placed with their noses immersed in the molten lead.

On either side of the lead pots are situated two punches, one a John Bertram & Sons' product, and the other a Canada Machinery Corporation product, both equipped with dies to nose the shells. The latter are taken from the lead pot, the steel disc placed inside, and the nose bottled in the punch. Fig. 12 shows the lead pots and these nosing presses. The noses of the shells are again placed in the lead pots for from twenty to thirty seconds to anneal them, as the thickness of the nose upon being bottled-in, is not great and the cold dies are bound to chill them somewhat. Thus, to facilitate the finishing of the noses, this procedure of semi-annealing is practised. The noses are allowed to cool in the air afterwards.

Sand Blasting, Hardness Test, Etc.

The shells next pass to the sand blast where the recess is cleaned up and the back of the body is polished. Fig. 13 shows the hardening furnaces, the oil tanks, the electric hoists above them, the annealing furnaces and two of the three sand blast outfits. From the sand blast the shells are taken over to the hardness testing department. Here a couple of spots on opposite sides of the shells about three inches from the back end, are cleaned up on buffing wheels. The shell is then passed under the Shore scleroscope to have its hardness tested. The finish machine operations follow.

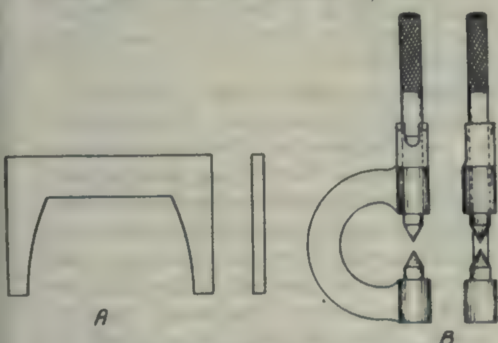


FIG. 15. GAUGES USED TO TEST SHELL AFTER FINISHING INSIDE OF NOSE.

Finishing Inside of Nose.

Several lathes are equipped for performing the finishing operations on the nose, all of these being equipped with cast iron chucks similar to those described in connection with the boring operations. Apparently there are three patterns from which the bodies of these chucks have been cast, but the principle of them all is identical. Fig. 14 shows the first lathe, a Smith & Coventry turret lathe tooled up to finish the nose. All the tools are here placed on the turret of the machine. The first tool to enter the work is an ordinary boring tool carried on a boring bar. This tool rough bores the nose. A finish boring tool with two cutting edges is carried on the same bar as also is a tool for facing the end of the shell. The turret is traveled toward the head-stock of the lathe and these two tools come into the work. A cast iron stop in front of which is placed a V-block on the ways of the machine acts as a stop for the turret carriage. As the shell is chucked against a stop this tooling finish faces the shell to length. The boring bar is withdrawn and the turret swung.

The next bar carries a wide cutting tool, the cutting edge of which has been ground to roughly turn and form the nose. A stop on the lathe indicates when the proper amount of metal has been removed. At A, in Fig. 15, the gauge for testing the diameter and contour of the nose of the shell is shown. The turret is swung again, and a similar tool carried on a short rigid bar is now swung into position. This tool is to finish turn and form the inside contour of the nose. Then the turret is swung, and a collapsible tap is used to cut the thread on the inside of the nose. The thickness of the metal in the nose is tested with the gauge shown at B, in Fig. 15.

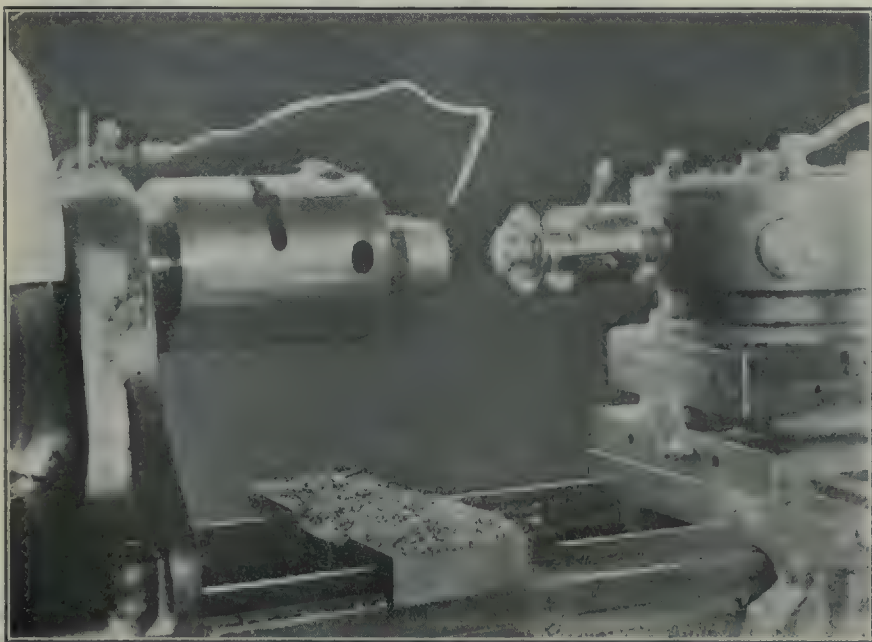


FIG. 14. FINISHING INSIDE OF NOSE OF 18-PDR. SHRAPNEL SHELL ON A SMITH & COVENTRY ENGINE LATHE.

This completes the series of operations on this machine. There are also two MacGregor, Gourlay turret lathes somewhat similarly tooled, the only difference in the tooling being that the turret carries a solid straight fluted reamer on a boring bar, which reamer is put through the nose before the collapsible tap.

A fourth machine on which these operations are done is a Warner & Swasey turret lathe. The turret of this lathe is of rather too light construction to withstand the heavy cutting of the turning and forming operations of the inside and outside of the nose. Thus, on this lathe these tools are carried on a special turret tool holder mounted on the cross slide. Two boring bars are attached to the turret. The first of these bars carries the rough boring tool, the two-edge cutter finish boring tool, and end facing tool. The second bar carries the collapsible tap.

Finish Grinding.

The next operation on the shell is the finishing of the outside of the bodies. This is done in either of two ways in this plant. The first way is to grind the bodies to size, and the second is to turn them on engine lathes. There are two Norton grinders, one fitted with a stone to finish the bodies, and the other to

finish the noses. There are also two Landis machines, one to finish the bodies and the other to finish the noses. Before she shell can be ground, it has to be supplied with centres.

The shell is placed in the grinding machine with the nose end towards the head-stock of the machine. The square end of the plug centre in the nose fits into a slotted fixture on the live spindle of the machine and the shell is thus driven. The nose end of the shell is usually ground before the body. A wheel is used, the face of which has been dressed to the proper curve to form correctly the nose. The stone is frequently dressed to ensure accuracy. The diameter and profile of the nose is tested by gauge. The bodies of the shells are ground on a flat wheel of six inches face. This wheel is not traversed across the work. Fig 17 shows the Norton grinder with a shell in it having its body finished. The Landis machines are equipped with wheels similar to those used on the Norton machines. Owing to the hardening department having pretty thoroughly mastered their problems, not much difficulty is being experienced with the grinding.

Finish Turning.

A large number of shells are being finish turned. For this operation, the shells have also to be equipped with centres. On some machines the same centres are being used as are used for grinding. On other lathes, however, the centre shown in Fig. 18 is placed on the back end. The shell is placed with its nose to the face plate and the square end of the plug centre in the nose fits into the fixture

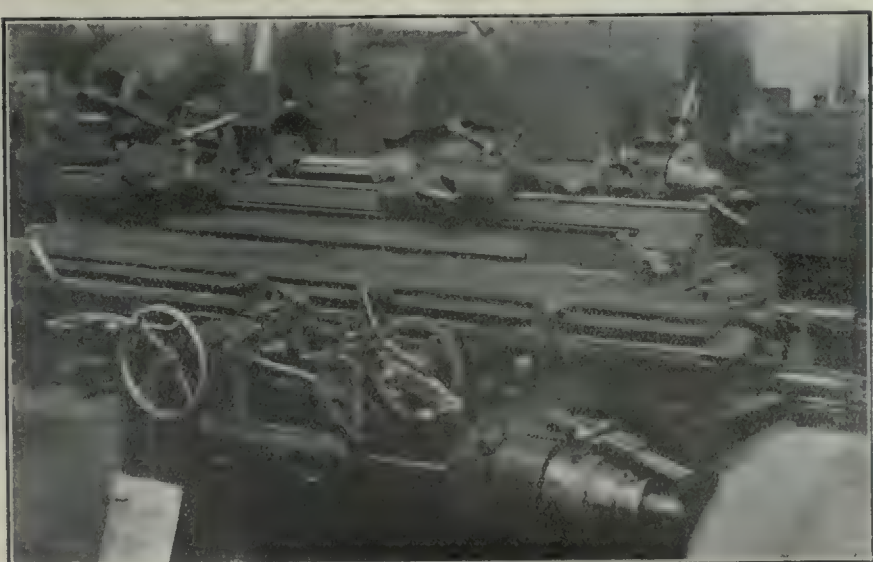


FIG. 17. GRINDING BODIES OF 18-PDR. SHRAPNEL SHELLS ON A "NORTON" GRINDER.

shown in Fig. 19, which is bolted to the face plate of the lathe.

In each case the cross slide feed has been disconnected. At the back of the machine, a piece of flat tool steel has been bolted. One edge of this flat piece of steel has been ground to the exact contour of the shell and hardened. Heavy weights suspended on wire ropes attached to the cross slide, keep a fixture which has a hardened steel guide point

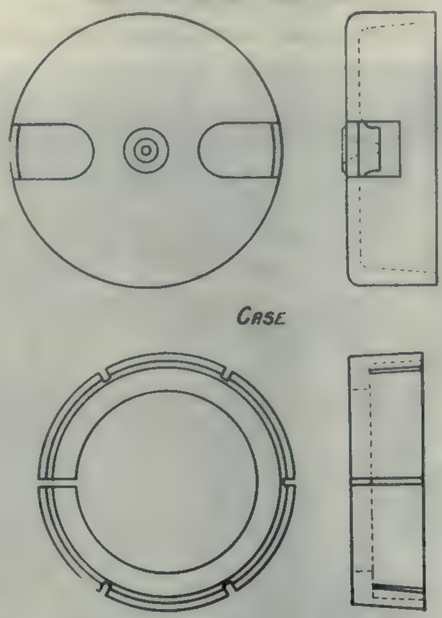


FIG. 18. CENTRE USED FOR TURNING.

and is bolted to the cross slide, pressing firmly against the formed edge of the hardened steel gauge. Adjustments of the compound rest, with which all these lathes are equipped, feed the tool into the work. The carriage is traveled by power and the cross slide is guided by the template. Thus the body is turned and the nose turned and formed.

Twelve engine lathes altogether are engaged on finish turning. As soon as the shells are turned, the centres are removed, then three "nicks" made with a cold chisel, are given the wave lines. This, it has been found, allows the air to escape from between the wave lines when the copper bands are pressed into the grooves, and thus they are better able to fulfil their functions. The shells are marked on a Dwight slate stamping machine and then pass on to the preliminary Government inspection because at this stage the complete operations on the body of the steel shell have been finished.

Applying and Turning Copper Bands.

After the shells are received from the preliminary Government inspection, they are taken to the banding presses. Here the bands are slipped over the ends of the shells and a hammer blow, elongates them sufficiently to keep them in the recess. They are then placed in a Lymburner press. Two applications of the jaws are sufficient to squeeze the band home for keeps. The shell is given a slight twist between the first and second application of the jaws.

There are six lathes in all engaged in band turning, these include one Warney & Swasey, and one Acme, which are turrets; one Canada Machinery Corporation, one R. McDougall, and two MacGregor, Gourlay engine lathes fitted up for the work. All are equipped with collet chucks into which the shells are placed up against a stop. On the turret lathes an overhead roughing tool takes a roughing cut from the copper band; then the turret is swung and a revolving centre is brought to support the back end of the shell. The finish cutter is fed in from the cross slide and the cutting edge of this tool is so ground that the finished contour of the copper bands is formed. Limit ring gauges are provided to test the work. The engine lathes are also equipped with collect chucks. No support is given the outer end of the lathe as the shell body is grasped well up in the chuck. The shell in each case is placed up against a stop in the chuck.

Both the roughing cutter and the finish cutter are carried on the cross slide as may be seen by referring to Fig. 20. which shows a MacGregor, Gourlay lathe tooled up to turn the copper bands. The roughing tool approaches the work from the back, while the finishing cutter which is very solidly clamped to a special tool holder approaches the work from the front. The carriage is placed against a locating stop when the finish turning is being done. All the engine lathes doing this work are very similarly equipped. The shell now passes on to the assembling department.

Assembling.

As soon as the shell arrives at the assembling department, the little powder cup is placed in the shell and with a

quick manipulation of the hand at which the men become very expert, the cup is placed below the steel disc or diaphragm. The brass powder tube is then screwed in the disc and the disc seated firmly. A funnel is now placed over the mouth of the shell. A central rod attached to the funnel performs a double duty as it slips into the powder tube, for it not only centres it but keeps shot and other material from getting into the tube. The shell is now placed on a vibrator and the shot put in from a self-measuring device. This automatic device is of course only approximately correct and it is not relied upon to determine the exact number of shot. As soon as the shot have all seated down into the body of the shell and are firmly packed there by the action of the vibrator, the shell is put under one of the resin pots and filled with molten resin. To keep the resin from getting into the brass powder tubes, small wooden plugs are placed in the tube by hand, and these remain there while the resin is being poured.

The shell is now carefully weighed on a delicate balance, and, if it be light, one or two shot are added to make up

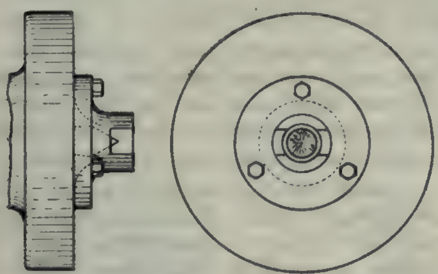


FIG. 19. DRIVER FOR TURNING SHELL BOLTED TO FACEPLATE.

the weight. On the other hand if it be heavy, a shot or two are removed. The shell is next clamped in a vise and the brass socket screwed into the nose. The brass threads are coated with red lead cut in oil previous to being screwed in the noses. Pipe tongs are used to screw the sockets home solidly. The shells now pass in to the soldering operation. The powder tube extends through the central hole of the socket when the socket is screwed down, and the powder tube is soldered to the socket by a specially constructed soldering iron. After this operation, the shell is ready to pass on to the brass turning lathes where the sockets are finished.

Finishing the Brass Sockets.

Altogether, there are eight small turret lathes fitted up for the machining of the brass sockets. Although products of three different factories, namely the John Bertram & Sons, Dundas; Smith & Coventry, Manchester, England; and the Warner & Swasey Machine Tool Co., Cleveland, Ohio, the lathes are all similarly designed, and their tooling very similar. Fig. 21 shows one of the Smith & Coventry lathes tooled up for the work. It will be noted that the shell is held in a special two-jaw chuck and a steady rest. The two jaws of the chuck are self-centreing and the shell fits up

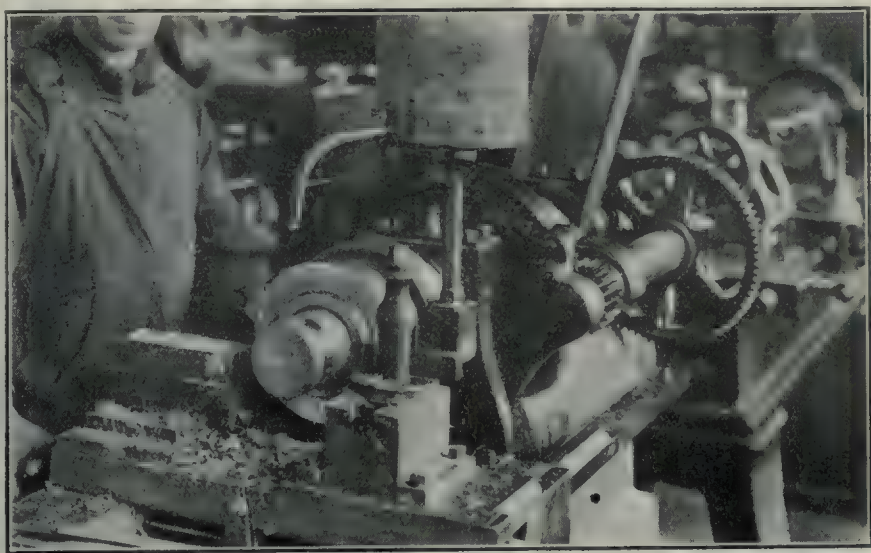


FIG. 20. TURNING COPPER BANDS ON A McGREGOR-GOURLAY ENGINE LATHE.

against a shoulder in the jaws. The steady rest is the standard type of rest in every respect except that the jaws are of bronze.

The first tool on the turret is the rough turning and forming tool which is fed longitudinally into the work. The next tool is the finish turning and forming tool which is fed slowly into the work with the lathe also revolving slowly. In both these operations, the carriage is fed up to a stop. The next tool turns down the socket for a short distance, it also being fed into the work longitudinally. The projecting end of the powder tube is now trimmed. A scraper rest is next brought into position, and the bottom of the socket and the end of the tube are touched with the scraper as is also the outside diameter. Sometimes the outside diameter is also touched with a file. With the completion of this operation the machining of the shell is finished. In passing a rigid shop inspection, finish taps are run into the socket and a finish tap is also run into the grub screw hole; the powder tube is cleaned out and reamed and the powder cup is cleaned out with compressed air. When these operations are completed the shell passes on to the final Government inspection, upon being returned from which the painting operation follows.

Painting.

The first painting is to give the shell a coat of black Japan as a primer. This is done on a specially constructed painting table which is shown in Fig. 22. Three cups, into which the nose of the shells fit, project through the top of the table. Each one of these cups is attach-

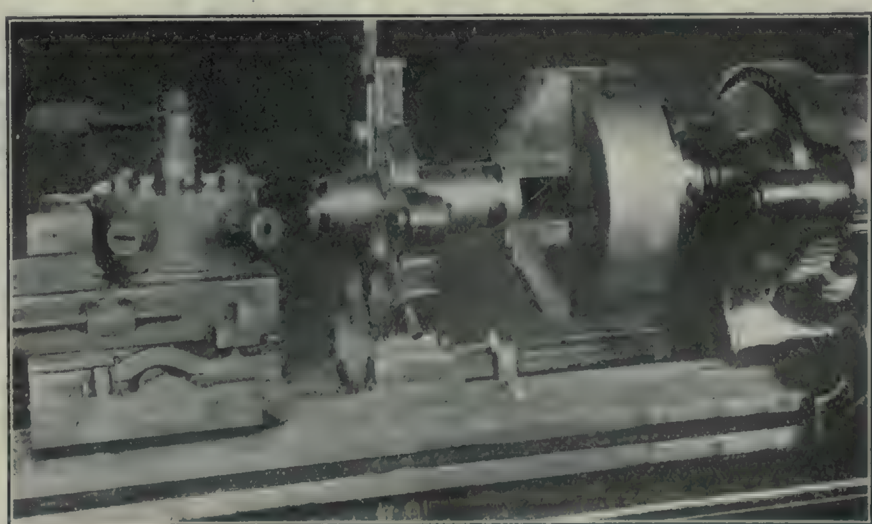


FIG. 21. TURNING BRASS SOCKETS ON A SMITH & COVENTRY BRASS TURNING TURRET LATHE.

ed to one of the little shafts which carry the gears of a train of spur gears, one gear of which is driven by a small electric motor, being belt connected to same. Thus, the little cups revolve, and when a shell is simply placed in the cups it stands vertically and revolves. Hence the application of the paint is a very simple matter. The brass socket which is not coated with black Japan is inside the retaining steel cup and the operator is in no danger of getting it smeared with paint: a large number of shells can be painted in a short time by a couple or three men. The finishing coat of a dark slate color is not done on this apparatus. The noses have to be painted with red lead.

It was found out when painting the finishing coat on this machine that the paint was inclined to run into the red leaded nose which made a messy appearance. Hence a horizontal apparatus has been devised. Before being finish painted, the little brass plugs are screwed in the sockets. and these keep all dirt out of the powder tube and cup, and at the same time protect the thread of the socket from injury. The brass plugs have a square hole in the head. A little motor driven lathe has been built. and the end of the live spindle has been slightly cupped out to receive the back end of the shell. On the tail-stock spindle, is a square centre which fits into the brass plug in the socket. The shell is simply placed in the revolving centre and the tail stock spindle screwed up. it not being necessary to stop the lathe to do so. Two pots of paint are carried on a shelf behind the lathe. and the paint brushes are tied by cord to the little bracket on the paint shelf. Thus the operator merely reaches out for the brush after he has put a shell in place. One man paints the body altogether, while a second man red leads the nose and assists on the body. The shells are afterwards taken out and placed on drying shelves where the back ends are painted. Packing in boxes of six and shipment follows.

General.

The total production of the plant is about fifteen hundred finished shells per day, but it is expected that this number will be increased to two thousand a day very shortly. Three shifts of men per day are worked, each shift working eight hours straight. The remuneration is on a strictly piece-work basis.

All the tools are giving excellent satisfaction and all the departments are working well together. It is very remarkable indeed to think that less than a year ago this shell shop was known as the "Frog Shop" of the establishment. That such a different product could be manufactured in such quantities and in so short a time is indeed remarkable and too much credit cannot be given the plant engineering corps for their enterprise.

Chapman double ball bearing elevating trucks are much in evidence about the shop, while various types of platforms have also been constructed.

The artificial and natural lighting are both excellent, the ventilation of the shop is also good, and as a consequence the output is secured under highly favorable conditions for both employer and employee.

FIG. 22. PAINTING THE PRIMING COAT ON 18-PDR. SHRAPNEL SHELLS.

RELATIVE NUMBERS OF COMBATANTS.

A writer in the Fortnightly Review analyses British, French and German strength in men as follows:

	Numbers before war.	Computed losses.	Numbers to-day.
Germany	16,400,000	2,000,000	14,400,000
U. Kingdom ..	11,130,000	104,000	11,026,000
France	9,660,000	900,000	8,760,000

Deducting those lost to industry by present military service he arrives at the following table:

	Germany.	U.K.	France.
Men between ages of 17 and 55, less by casualties deducted	14,400,000	11,026,000	8,760,000
Lost to industry by present military service (deduct)	5,000,000	2,500,000	3,000,000
Left for industry	9,400,000	8,526,000	5,760,000

Extent to which countries can reduce their normal working population for the purposes of military service:

	Germany.	U.K.	France.
Total number of males of military age	14,400,000	11,030,000	8,760,000
Number withdrawn from industry.	5,000,000	2,500,000	3,000,000
Number not yet withdrawn ...	9,400,000	8,530,000	5,760,000
Number normally employed in industries of the first necessity.	8,200,000	5,260,000	4,400,000
Number left available for other industries	1,200,000	3,270,000	1,360,000

SHELL WASTE UNAVOIDABLE.

LIEUT.-COL. BOISSONNET explains in the Temps some of the many reasons which make spendthrift artillery one of the necessary factors of victory:

The French "75" is a weapon of marvelous precision, but even with a new gun and the shells in perfect condition, after firing a great number of shots from a distance of 3,000 metres, the shells will be found to have fallen within a radius of ninety-six metres, and for one-half the radius will have fallen in a strip of about twenty-four metres. The gunner, therefore, has to regulate his fire so that the object aimed at will be in the centre of this most thickly covered strip, a task which against trenches, even after aeroplane reconnaissances, requires a considerable expenditure of ammunition. Again, when it is remembered that the trench itself is not much more than a yard or so wide, it will be realized that for every three or four shells which burst in the trench there are a vast number which explode before it or behind it.

Waste Likely to Increase.

The need for heavy shell expenditure against trenches is already great, but it will become more urgent still after the siege period is over and real field fighting again becomes possible; when the artillery will have not the fixed target of the trench line but the thin mobile ranks of skirmishers as its objective.

Against moving infantry, unless it is advancing in close formation, regulated fire is a matter of some difficulty. Infantry which finds themselves between the first shell which has burst behind them and the short shell which has burst in front of them do not await the avalanche which is to follow, but rush rapidly forward beyond the first short shell, where they fling themselves to the ground under what cover they can find. The artillerymen know that they are somewhere in the neighborhood, and to begin again the tire de reglage would only be a loss of time, so that the only thing for the artillery to do is to shorten its range by 100 yards or so and to sweep with shrapnel the whole of the zone where they imagine the enemy's infantry to be.

A battery of "75" guns fires no less than eight shells a minute, and it is only with rapid, intense fire that the shrapnel fragments can sweep a whole countryside and break the enemy's attack. The same thing applies when the artillery is taking part in an offensive. They have to cover the whole zone of the enemy's front with a shower of shells, forcing the gunners to take shelter and pinning the infantry to the ground while their own troops are advancing to the attack.

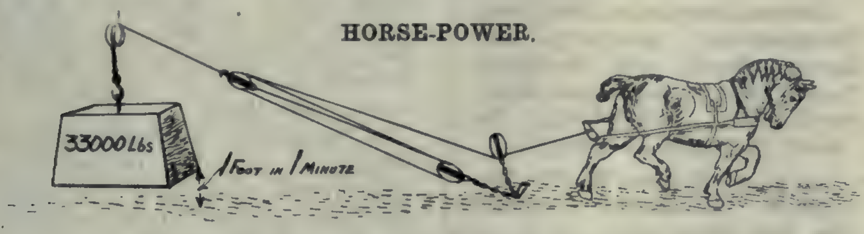
EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

FORCE, WORK AND POWER.

By A. F. White.

ALTHOUGH much has been written on this subject, and nearly every mechanical text-book and pocket diary clearly defines the term "Horse Power," perhaps the following description, with a few practical illustrations, may not come amiss to those who are not thoroughly conversant with the relation that exists between the terms—Force, Work and Power.



REPRESENTATION OF FORCE, WORK AND POWER.

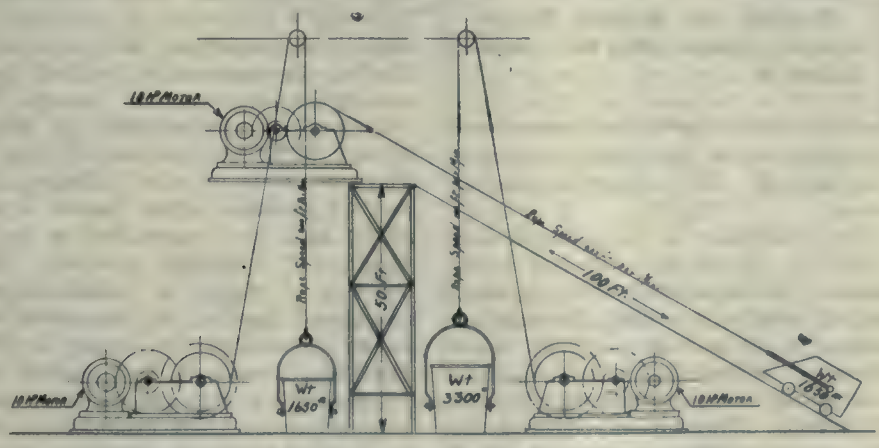
The writer, being connected with a company manufacturing haulage and hoisting engines, is often called upon to figure out simple problems regarding horse-power. A customer will sometimes write in, informing us that he has a load of, say 5,000 lb., which he requires to lift a distance of, say 200 feet. He invariably omits to mention at what speed this load has to be raised and expects us to quote on a machine of suitable capacity, and much time is often wasted in this way—writing in to obtain the necessary information. For the benefit of those who need a little rub up on the question, this article is written.

When the steam engine first came into use it was applied to doing work which had previously been done by horses, and it was estimated by James Watt that an average heavy-draft horse could do work continuously at an average rate of 33,000 foot pounds per minute. This was established as the standard horse-power, and has remained unchanged.

Horse-power is a combination of the three terms—"Force," "Work" and "Power."

Force is that which tends to produce motion. Steam exerts a force when it presses against the piston of an engine; also, a clock weight pulls on the cord and exerts a force on the works of a clock. These forces are expressed in pounds.

Work is produced by the exertion of force through space. A force is of no use for the production of power unless it can be made to move something. The pressure of steam against a piston does no work, produces no energy, until the piston commences to move; neither does a clock-weight do work when the clock is not running, although it pulls just as hard on the cord. Thus, a force may persist forever and cost nothing, but as soon as work begins to be done, energy is exerted and something begins to be used up, the force being expressed in pounds, and the space through which it acts in feet. The product which represents energy is expressed in foot-pounds. A foot-pound is called the unit of work, and is the work done when a resistance of one pound is overcome through a space of one foot. If a resistance of two pounds be overcome through a space of one foot, then twice as much work is done or two foot-pounds; also, one pound through a space of two feet represents two foot-pounds.



FIGS. 1, 2, 3. ELECTRIC HOIST REPRESENTATIONS.

Power.—The power of a machine is a measure of the work which it is able to do in a given time. It is expressed in foot-pounds per minute, hour, or second, and is the product of the force and the space through which it is exerted, divided by the time occupied by the movement. It takes a larger machine to do a given amount of work in a short time than in a longer time; and a little pump will pump as much water as a larger pump if it is given time.

Raising 33,000 lb. through a height of one foot in one minute, or one pound through a height of 33,000 feet in the same time, equals 33,000 foot-pounds per minute, and is considered equivalent to one horse-power. Thus, 33,000 lb. raised 2 feet in one minute is 66,000 foot-pounds, and equivalent to 2 horse-power. In this way it can readily be understood that unless the element of time is considered, the power cannot be calculated. I will explain the foregoing with a few illustrations of practical applications of this rule.

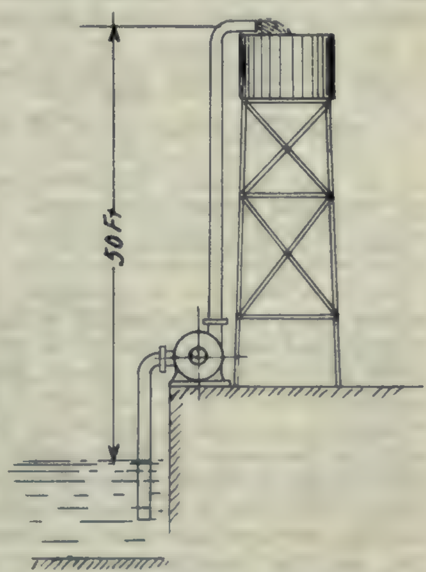


FIG. 4. FORCE, WORK AND POWER OF CENTRIFUGAL PUMP.

Figures 1, 2 and 3 represent an electric hoist such as often used by contractors; each hoist is fitted with a 10 h.p. motor, and performs the same amount of work in a somewhat different manner. In Fig. 1 the weight is 1,650 lb. and the estimated time to elevate same to the top of the platform which is 50 ft. high,

is 15 seconds, or ¼ of a minute, this being at the rate of 200 feet per minute. Then, $1,650 \times 200 = 330,000$ foot-pounds per minute, and the standard horse-power being 33,000 foot-pounds, we get $\frac{330,000}{33,000} = 10$ horse-power.

Figure 2 illustrates a slow-speed hoist. The weight in this case is 3,300 lb., and the estimated time to elevate the load to the top of platform is a half-minute, which is 100 feet per minute, and half the speed of Fig. 1; so that $3,300 \times 10 = 333,000$ foot-pounds, which is the same amount of work done as Fig. 1, and 10 h.p. are used up in each case.

Figure 3 is another example, the height of the trestle being the same. The material and the bucket weight the same as in Fig. 1; also, the time taken to hoist is the same; therefore, the same amount of work is done, and the same power is required. In this case the incline is at an angle of 30° and the hypothenuse of a 30° triangle is twice the length of the side, so that the distance travelled will be 100 ft., and the time taken ¼ of a minute, being at the rate of 400 feet per minute. The pull on the rope at this incline will be ½ that of a vertical lift; then, $\frac{1650}{2} = 825$ lb. = the load, including friction; then, $825 \times 400 = 330,000$ foot-pounds, or 10 h.p., as Figs. 1 and 2. This hoist is geared with twice the speed as in Fig. 1.

Figure 4 illustrates a centrifugal or turbine pump operating against a head of 50 ft., and pumping water at the rate of 660 Imperial gallons per minute. One Imperial gallon = 10 lb., then $660 \times 10 = 6,600$ lb., and this multiplied by the height in feet as in the former cases = $6,600 \times 50 = 330,000$ foot-pounds, or 10 h.p. Of course, in this case, friction, etc., has not been taken into consideration, and this varies considerably in pumps, and the efficiency may be anywhere from 40 per cent. to 70 per cent.

The foregoing may be considered very elementary by those who know, but it is for those who do not know that the article is written.

USE OF SPINDLE GREASE CUPS.

By C. T. P.

SINCE the first spindle cup made its appearance, many styles and kinds have been used with more or less success. The original theory covering the spindle type of cup has, in many instances, been lost sight of, and the operation of the cup itself attributed to various make-shift theories which are without a sound basis. For instance, some advance the idea that the spindle resting on the shaft in a grease cup filled with a mineral or ordinary grease revolves, due to the rotation of the shaft, and in that way creates a disturbance in the midst of the grease in the cup, which causes the grease to flow and lubricate the bearing. This theory was never advanced on engineering experience. It is entirely unsound.

Others have advanced the idea that the spindle in a grease cup filled with a mineral or ordinary grease, works in a vertical direction through the grease and in that way is supposed to hop up and down in the cup and practically poke or push the grease to the bearing. This movement of the spindle is supposed to be produced by the action of the shaft which has some free-play in the bearing. This theory is also unsound.

The true theory or the principle upon which the spindle cup acts is a fundamental. The spindle type of cup should only be used with a solid lubricant possessing a low melting point. By this is meant a lubricant that will flow at a temperature ranging from 50° Fahr. to 175° Fahr. Never in any instance, use in any make, style or kind of spindle cup, a mineral or ordinary grease of higher melting point.

The spindle should be of soft copper, sheathed from the bottom to about half its length with a piece of corrugated copper. As copper is a good conductor of heat, the copper sheathed spindle, resting on the shaft, feels every fluctuation in bearing temperature. This, due to the high conductivity of the spindle, is readily impressed upon a low melting point grease or compound which flows, thereby reducing the bearing temperature to normal and then solidifying again. In this way practical, automatic lubrication is secured. The spindle vibrates but little, does not revolve and does not hop or jump in the grease cup.

COMING CONVENTIONS.

American Supply and Machinery Manufacturers' Association and National Supply and Machinery Dealers' Association, Hotel Bellevue-Stratford, Philadelphia, Pa. (Joint convention.)—June 3-5.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Railway Supply Manufacturers' Association. Convention and exhibit in conjunction with the Railway Master Mechanics and the Master Car Builders.—June 9-16.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring Meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

MANUFACTURERS PLAN TRADE EXTENSION.

THE Canadian Manufacturers' Association will hold its annual general meeting on June 8, 9 and 10 in the King Edward Hotel, Toronto. The sessions, it is announced, will be more informal than usual, entertainment features being considerably curtailed, in keeping with the spirit of the times.

On the opening day, matters somewhat outside the convention program proper will be dealt with. These will include a discussion of the "Made in Canada" campaign, the proposal to bring about a federation of safety associations under the Workmen's Compensation Act of Ontario, and the formation of an export trade association to improve Canada's strategical position abroad and to assist her in profiting by the exceptional business opportunities offering now. The second day will be devoted to the business of a regular annual meeting and the third for committee reports and the election of officers and amendments to by-laws. An informal dinner at 6.30 will close the proceedings.

COPPER REFINING PLANT PROPOSED

THE establishment of a plant for copper refining will likely take place, following a conference on Saturday between the Minister of Militia, General Hughes, the chairman of the Shell Committee, Col. Bertram, Col. Carnegie, Dr. Wilson of the Department of Mines, Messrs. W. D. Matthews and Warren, of Toronto. It is intended to have every part of the shells which Canada is supplying made in Canada, and as far as possible of Canadian products. The smelting of copper in Canada is now considered feasible, and the plant will in all probability be located in New Ontario. Canada is now turning out 30,000 shells a day, and Canadian factories are making high explosives as well as shrapnel shells. A very large amount of Canadian lead has been used in the manufacture of munitions for the British army, the lead mines having contributed 50,000 tons of lead, shipped to England since the outbreak of the war.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

It will be found by those who have follow ed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

LEVERS.—II.

IN chart 51 are shown some practical applications of the simple lever. At A and B are shown two views of a lathe tool operating on a shaft. The arc (ab) shows the tendency of the tool to dig into the work, the tool swinging from the point (o) with a radius equal to (oa). From the position of the arc (ab), it would appear that it makes little difference just where the tool is situated, but, from a study of the lever diagram below each view, it will become quite clear that wherever conditions permit, the cutting point of the tool should be kept as close to the fulcrum or point (O) as possible.

Suppose that a pressure of 1,000 lbs. is exerted upon the screw of the tool post in both cases, and the length L and l in A are 3 inches and 3 inches respectively, and in B, 1 in. and 3 in. respectively, what resistance can be overcome at the cutting edge of tool?

For A:—$W = \frac{PL}{l} = \frac{1000 \times 3}{3}$

$= 1{,}000$ lbs.

For B:—$W = \frac{PL}{l} \quad \frac{1000 \times 3}{1}$

$= 3{,}000$ lbs.

The same principle applies to the use of the planer or shaper tool. This if not of sufficient strength to resist the action of the cut, will have a tendency to spring and revolve about the point (o), making the tool dig into the work as shown at (ab). If the tool be formed to bring the cutting point in a vertical line with the point (o) as shown by the dotted lines, this objection will be overcome as any excess pressure acting upon the tool will cause it to move away from the work. This is also true as regards the side thrust of the tool as shown at D. The tool if possible should be secured at right angles to the centre line of the shaft, and, to secure more stability, the tool can be fastened as shown, the contact points (a a) increasing its rigidity.

When motion is required to make a weight through considerable space, or the transmitting of power from one location to another, the simple lever must be transformed into a continuous lever composed of pulleys, gears, etc.

Chart 52 shows a pulley directly connected to a drum, upon which is wound a cable to raise the weight W.

This arrangement comprises the continuous use of the simple lever of the second order, the centre of the shaft representing the fulcrum, the radius of the drum equalling the weight arm, and the radius of the pulley equalling the power arm. A pull of 800 lbs. is exerted at P; what must the diameter of the drum be to raise a weight of 2,000 lbs., if the diameter of the pulley is 30 inches?

By formula:—$P \times D = W \times d$, or

$$d = \frac{P \times D}{W} = \frac{800 \times 30}{2000} = 12''$$

In the lower half of chart 52 is shown a sketch of a train of gears and pulleys which comprises the continuous applications of the compound lever. A weight W of $1\frac{1}{2}$ tons is suspended from a cable running over a drum of 15 inches diameter; directly connected to the gear N_1 of 85 teeth, meshing with a pinion (n_1) of 35 teeth, which is directly connected to a gear N of 80 teeth, which meshes with a pinion (n) of 30 teeth, directly connected to a pulley of 36 inches dia.; what must be the pull upon the belt to raise the weight W, gears and pinions of 2 diametral pitch?

By formula we have:— $P \times D \times N \times N_1 = W \times d \times n_1 \times n$, or

$$P = \frac{W \times d \times n_1 \times n}{D \times N \times N_1} = \frac{3000 \times 15 \times 35 \times 30}{36 \times 80 \times 85} = 193 \text{ lbs.}$$

By using the formula for compound levers in chart 49, we have :—

$$P = \frac{W \times l'' \times l' \times l''}{L'' \times L' \times L} = \frac{3000 \times 7.5 \times 8.75 \times 7.5}{21.25 \times 20 \times 18} = 193 \text{ lbs.}$$

The diameters of the gears and pinions are found by dividing the number of teeth by the diametral pitch; and the length of the power or weight arms is the radius of the gears or pulleys.

What would be the speed of the belt in feet per minute in the above example, to raise the weight at the rate of 2 ft. a second?

2 ft. per second = 120 ft. per minute, and revs. per min. of drum

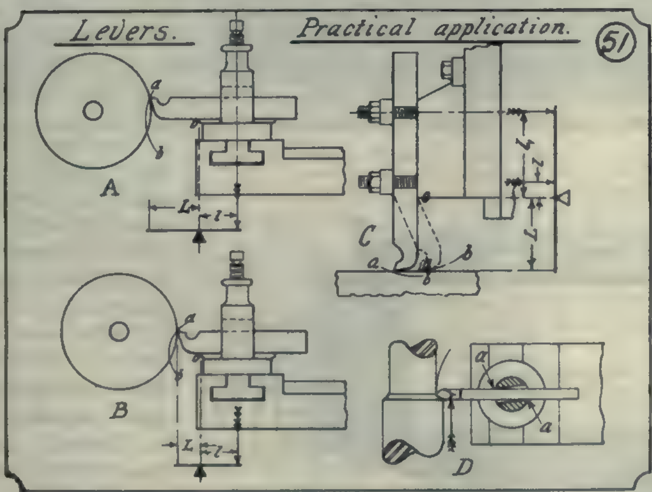
$$\frac{120 \times 12}{15 \times 3.1416} = 30.56.$$

Revs. per min. of driving pulley.

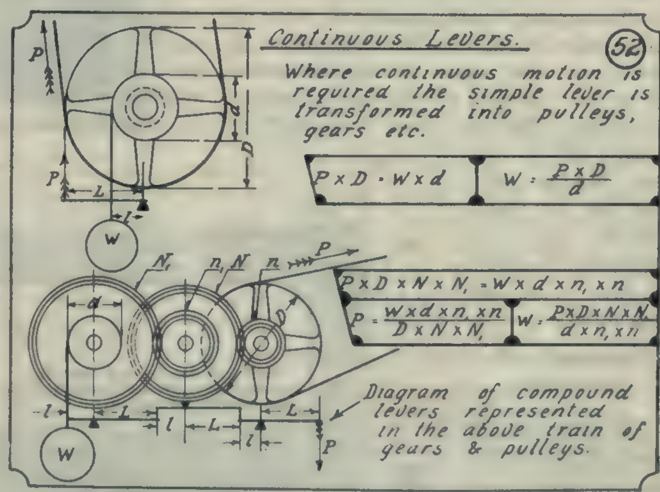
$$\frac{30.56 \times 85 \times 80}{35 \times 30} = 197.9 \text{ or } 198 \text{ r.p.m.}$$

Speed of belt

$$\frac{36 \times 3.1416 \times 198}{12} = 1866 \text{ ft. per min.}$$



ARITHMETIC CHART 51.



ARITHMETIC CHART 52.

CONCERNING HIGH EXPLOSIVE SHELLS.

By H. A. W.

A CIRCUMSTANCE that will to some extent lessen the amount of idle time of many machine tools meantime intermittently employed on shrapnel, is to be found in the distribution of contracts for 3.3 and 4.5 high explosive shells. As regards the former, neither forging nor nosing are required, the black steel bars, about 3½ in. in diameter, being cut to approximate finished length, bored out parallel to required depth, internally threaded at nose, finish turned parallel outside for the greater part of shell length, form turned outside at nose, and recessed, threaded, and plugged for part of base thickness outside, etc.

For the most part, our machine shops with contracts for 3.3 high explosive shells, have not yet got past the experimental stage in the development of attachments to their standard equipment, or in the installation of new and special machines, but from what we have seen of the progress made, there is every indication that quite as much enterprise as that shown in handling the shrapnel problem will be finally evident. While fewer accessory parts constitute the 3.3 high explosive shell, the recessing and waving for the copper band, the pressing on and turning of the latter remain a necessary feature. Heat treatment is absent, but a varnish baking process for the shell interior may be reckoned to some extent as an equivalent.

Sequence of Operations.

The approximate finished length black bars are first centred on drill presses, then rough turned on ordinary engine lathes, being turned straight or parallel without form template attachment. A second rough turning operation on turret lathes follows, after which the copper band recess and wave lines are formed. Drilling out the solid bar comes next, after which, on turret lathes, forming the nose, finish boring, and an internal recess or groove cut by a relief thread-cutting tool, constitute the feature operations. A three-thread chaser cuts the thread, after which the finish turning on engine lathes is accomplished with forming cams.

The base is next bored out to accommodate the base-plate, which is a forging, the idea for same and the necessary tapped counterbore being that bar stock is apt to have a "pipe" in it. The baseplate is faced off flush after being screwed home. The forging is a homogeneous piece of metal, strengthening the base, and preventing the tremendous firing pressure rupturing the base and igniting the high explosive in the shell, and thus destroying the gun and most probably killing the gun crew. Reinforcement is more than anything else, perhaps, the reason for the insertion of the baseplate.

The inside of the shell is next varnished or enamelled and dried in ovens, whose temperature is 800 deg. F., for a period of eight hours. Following this, the copper band is pressed on and turned, and cast iron plug screwed into the open end, thus completing the Canadian manufacture of 3.3 high explosive shells.

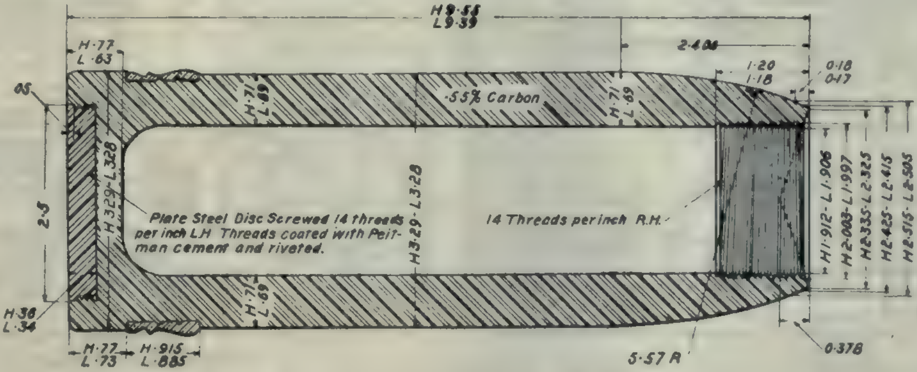
Heavy duty drills are, we understand, being requisitioned for the rough boring operation, and single spindle vertical drill presses operating high speed heavy twist drills are being tried out.

4.5 High Explosive Shells.

As to the 4.5 high explosive shells, contracts for machining large quantities of which have also been placed, practically nothing so far has been done either in the matter of experimenting or output. This particular projectile in its body element combines both size and weight in considerable measure, and although progress is meantime in abeyance, it may be assumed with considerable certainty that the shells will reach our machine shops as forgings instead of bar lengths as in the case of the 3.3 high explosive missile.

The 4.5 high explosive shell is nosed and corresponds in its machining to that of shrapnel. The nosing requires such an abnormal pressure, however, that the probability of steam hammers being requisitioned is great. This shell is bored all the way down and is also varnished.

Although none of our shops are yet equipped to handle them, heavy duty lathes rather than the lighter turrets are the meantime outlook.



Wave same as 18-pound shrapnel. No heat treatment

BRITISH 18-POUNDER HIGH EXPLOSIVE SHELL.

High Explosive Shell Output.

We expect that the output of high explosive shells, 3.3 and 4.5 will greatly exceed that of shrapnel, for the reasons that not only is there less detail to be cared for, but our plant staffs—administrative and operative, are now more expert, and therefore more confident.

The already recorded achievement of our engineering and metal working plants is, we make bold to say, in every-day peril of passing into the commonplace so far as shell output is concerned, and with every evidence of a long war and a steady demand for shrapnel and lyddite projectiles, it is highly probable that the achievement in which we meantime take a justifiable pride, will, six months or less hence, be scheduled as something quite mediocre.

SASKATCHEWAN INDUSTRIAL DEVELOPMENT.

INDUSTRIAL growth in Saskatchewan, while not as great in 1914 as in 1913, was greater than in 1912. There were 228 factories inspected last year compared with 240 in 1913, and 225 in 1912. The 228 factories employed 3,004 men and 368 women in 1914 and in all 14,531 horse-power was used, of which 10,359 was steam, 3,794 electric and 378 gasoline power.

The flour milling industry has made the greatest showing with an actual increase of $1,158,530 in gross value of products in 1914 over the year previous. The average annual earnings of employees rose from $543 to $602.

The decline of industries allied to the building trades is explained by the fact that the value of buildings constructed in 1914 in seven cities of the province, was in round numbers, $4,000,000, as compared with $13,000,000 in 1913.

Iron foundries and machine shops have taken a place in the industrial life of the province, and are doing a steadily increasing business in the manufacture of structural and bridge steel, water and sewer pipes, castings and ornamental iron work. The board of highway commissioners have purchased several standard steel bridges from Saskatchewan factories, and have others on order.

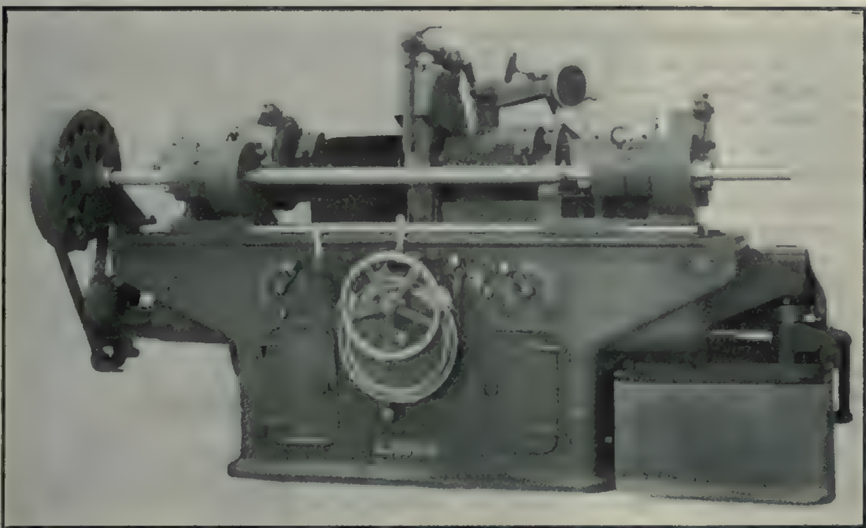
There were only two disputes between labor and capital during 1914, with 78 employees affected.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

FIXED THROW CRANK GRINDER.

THE description and illustration refer to a new fixed throw crank grinder, the heads of which are designed for the rapid handling of crank shafts when grinding pins, no indexing of heads, or taking crank out of machine before it is finished, being necessary. The cranks are fixed in position by means of a locating pin which enters hole in flange on the crank. These holes, having been drilled central with the pins, are finally used when clamping flywheel to the crank shaft. The heads will accommodate both single and double throw cranks, and are particularly adapted for cranks having a flange.



LANDIS FIXED THROW GRINDER.

The throw on machine can be changed by having other crank carrying fixtures supplied, and these can be furnished to handle double-throw cranks up to 6 in. and single-throw cranks up to 8 in. When grinding double-throw cranks, it is only necessary to loosen clamping bolts in crank carrying fixtures and turn crank around to grind other throws.

The design of the heads allows the wheel to be worn down to a much smaller diameter than ordinarily. It will, of course, be understood that the wheel cannot entirely be used up grinding pins, but can be worn down to a much smaller diameter grinding line bearings. The Landis Tool Co., Waynesboro, Pa., are responsible for the design and manufacture of this particular specialty.

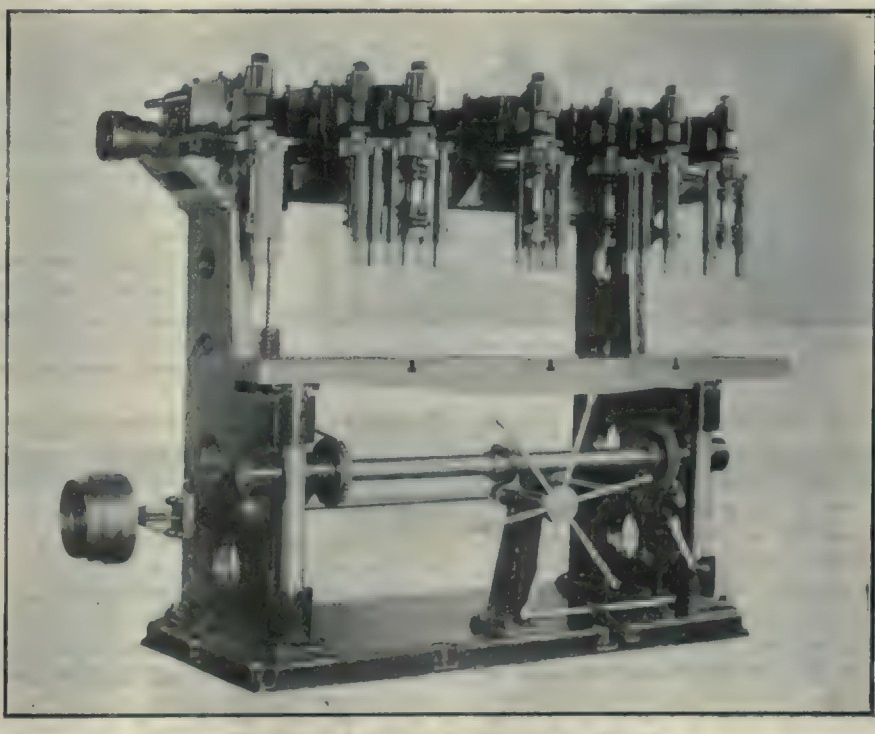
ADJUSTABLE SPINDLE BORING MACHINE.

THE machine shown herewith is a product of the Reynolds Pattern & Machine Co., Moline, Ill., and is intended to meet a growing demand for a substantial tool for wood boring and light metal drilling. The spindles are adjustable so as to reach any point in a space of considerable width, and of a length only limited by that of the machine itself. In the accompanying illustration, this space is 14 in. wide by 6 ft. Any point in this area can be reached and practically any pattern of holes can be drilled on this surface, being limited only by the minimum distance between spindle centres, of 2 inches.

The constructional features consist of substantial housings carrying a rail of considerable horizontal width and having its face upward, and a continuous spiral in a semi-circular groove in this upper face meshes with a spiral gear in the drill heads. These drill heads are adjustable to any point along the rail and have a horizontal adjustment also across the rail.

The drill spindles are carried in brackets which can be adjusted to any point on a complete circle around a central stud carried in the end of the drill heads. The drill spindles are driven through a spur gear on the upper end, meshing with a gear of double the width on this central stud, which in turn is driven through bevel gears from the spiral meshing with the main spiral. The driving gear on the central stud is made double the width of the pinions on the drill spindles so that these pinions may overlap each other in order to bring the spindles close together.

The table feed is by rack and pinion, the racks being cut on the flattened side of the steel table supports. The pinions are cut integral on the heavy feed shaft which is driven through worm and gear from the cone pulley on the end of the main driving spiral. The table is counterbalanced and has a pilot wheel for hand feed. The feed trip is by drop worm knock-out. Table can be fed up by



ADJUSTABLE SPINDLE BORING MACHINE.

hand until the work strikes the bits, the power feed being then thrown in by means of the foot lever. Hand trip is provided so that feed can be stopped at any point.

By means of the adjustment of heads on rail longitudinally and transversely and of the circular adjustment of the spindle around the central stud, any point in the space covered by the spindle can be reached and almost any pattern of holes desired may be drilled. For instance, an unlimited number of holes may be drilled in a straight line not less than 2 in. apart. Four holes can be drilled in a straight line crossways with the table not less than 2 in. apart, nor more than 14 in. apart, outside to outside. Six holes can be drilled on a circle of 2 in. radius. While 2 in. is the closest centre distance with the regular adjustable heads, special heads can be made for much closer center distances.

Each machine is furnished with gear guards (not shown) and is also equipped with countershaft or arranged for direct motor drive.

SHELL COPPER BAND TURNING LATHE.

IN connection with the manufacture of shrapnel and howitzer shells, the machine illustrated has recently been designed by Mr. Mills, chief engineer of the Jenckes Machine Co., Sherbrooke, Que., for turning the copper band on the shell after it has been put in place.

COPPER BAND TURNING LATHE FOR SHRAPNEL AND HOWITZER SHELLS.

Mr. Mills has, we understand, applied for a patent on this and other shell production equipment.

The bed of the machine is of the heavily ribbed flat top type, very substantial and mounted on standard legs. In place of the regular lathe headstock, two heavy copper bearings are used, each one secured to bed with four bolts. The caps are machine fitted and are held by four studs. The spindle is 6 in. diameter by 30 in. long, and is hollow turned all over and finished by grinding. The drive is through a 20 in. by 6½ in. clutch pulley, mounted on the spindle and bushed with bronze. The clutch is a hard maple cone of the full size of inside of pulley, and is operated by means of a lever extending from the far end of the spindle to within reach of the operator's left hand. The clutch mechanism is built into the spindle, and when in use has no tendency to move the latter endwise or cause end friction. Means are, however, provided for taking up end play of spindle should any wear occur. The chuck is a 15 in. three-jaw extra heavy geared scroll mechanism, and is bolted direct to the enlarged end of spindle. The tool slide base is extra heavy and is clamped immovably to the lathe bed.

The front or roughing tool is fed in by screw and hand-wheel to a dead stop and leaves a light cut for the finishing tool. The latter is mounted to the rear and above the work, and can be adjusted to pass down behind the shell, and, in passing, shave the band to size. The feed is by lever and pinion. The tools which can be removed for grinding and replaced with precision, are held in steel blocks by a clamp gripping their dovetailed portion, and are formed to shape of high-speed steel 4½ in. long. The shell is located by a swinging finger on front tool block before the chuck is tightened, and a hinged scraper rest is provided on front tool block for removing the ragged edge at each side of band after tooling. No countershaft is required. The belt is 6 double and the spindle runs 225 r.p.m. This equipment finishes the band on the 18-pdr. shell within a minute.

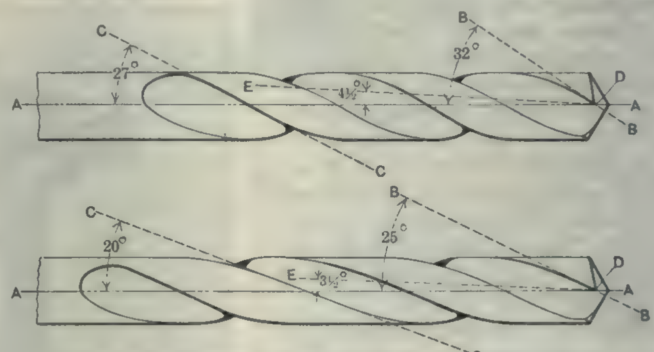
HIGH SPEED DRILL WITH GREATER TWIST ANGLE.

IN this latest product of the Detroit Twist Drill Co., Fort street west. Detroit, Mich., the outstanding feature is that the angle of drill twist has been increased, from 25 deg. at the point and 20 deg. at the shank, to 32 deg. at the point and 27° toward the shank. The contrast between the old angle and the new one is shown in the accompanying illustration. The line AA in each case represents the centre line of the drill, the cutting point being at O. The line BB is tangent to the flute at the cutting edge, and CC is the tangent near the shank, GOE being the angle of the cutting edge, which is usually known as the clearance angle.

This angle has been placed by common practice at about 12 deg., although it is entirely in the hands of the man who does the grinding. The clearance is indicated by the line OE, drawn at right angles to the centre of the drill. If a line is drawn to the left of the line OE, so that at a distance of 3 in. from O it is inclined about 0.008 in. to the left, it will represent the ordinary feed of a drill, 1 in. in diameter. This represents the angle at which the cutting edge is advancing into the work, which it will be seen is inappreciable as compared with the clearance angle.

The greatest percentage of gain, due to the increased angular twist in this drill, it is emphasized, is found in the improved cutting conditions at the centre of the drill next the web, where the angle corresponding to the rake of a lathe or planing machine tool is only a fraction of that at the outside of the drill. This is indicated by the dotted line OE, which in the older type of drill makes an angle with the axis of the drill of only 3½ deg., while in the new drill it is 4½ deg., an increase of approximately 30 per cent.

The increased angle of twist increases the amount of metal removed in making the drill, which in turn increases the area for chips. The curved side of the flute is shaped so that it will deflect the chip readily and form it into a spiral, which will preserve its shape, thus enabling the drill to clear itself readily. Where cast iron is being machined, the chips will not coil and free themselves in this way, but the curve of the flute is relied upon to break up the cast-iron chip and thus enable it to be pushed to the top of the hole or easily blown out if an air blast be used.



HIGH SPEED DRILL WITH GREATER TWIST ANGLE.

With the increased angle of twist, greater chip space, and a longer life to the drill are claimed.

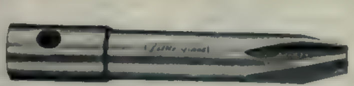
ADJUSTABLE FOUNDRY CLAMP.

AN adjustable foundry clamp for use in place of clamping iron and wedges has been placed on the market recently by the National Clamp Co., 1657 Monadnock building, Chicago.

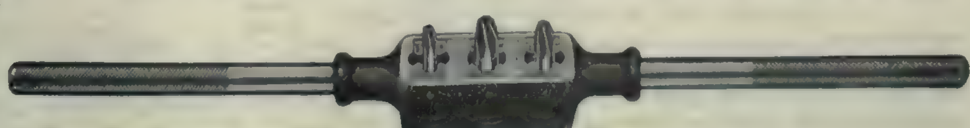
The constructional features consist of a jaw combined with a toothed rack along which a movable jaw slides, and this movable jaw carries a worm that is operated by a cold rolled steel handle. The worm has a heavy thread, a part of which is cut away to allow the movable jaw to slide freely along the rack. The remainder of the thread, when engaging the teeth of the rack, gives the clamping pressure. One turn of the handle causes a pressure movement of about ¾ of an inch.

ADJUSTABLE FOUNDRY CLAMP.

In operation, the stationary jaw is placed under and the movable jaw on top of the flask, after which a short turn of the handle gives the pressure necessary to clamp tightly. The device is of malleable iron, and of simple construction, and the claim is made that flasks are fastened quickly with a straight downward pressure, eliminating shifting and jarring. The action of the worm on the rack is positive and when drawn tight, the clamp will not loosen even on a jar-ramming machine. Five sizes are manufactured.



INTERNAL GUIDE WITH REAMER POINT



TRIO PIPE DIE STOCK WITH INTERNAL GUIDE.

COMPRESSED AIR METER.

THE aim and purpose of this compressed air meter, which is a product of the New Jersey Meter Co., Plainfield, N.J., is to measure the air consumption of any machine or application of compressed air, and the actual net production of air by any pump or compressor within its capacity. The meters have only one moving element—which floats on air, and is consequently frictionless and non-wearing.

The principal on which these meters operate is the well-known law deduced by the French scientist Poncelet, which may be briefly stated as follows:—The volume of a definite compressed fluid or gas flowing under small constant head through multiple orifices of the same shape and size, is directly proportional to the number of orifices exposed to the flow.

The moving element consists of a weighted piston in the upper or metering cylinder, a small piston in the oil dashpot cylinder and a rod joining the two pistons and extending upward where it moves freely, without contact, inside the sight glass at the top of the meter. This rod rises and falls with the pistons so that its height in the sight glass corresponds exactly to the position of the piston in the metering cylinder. The scale plate mounted against the outside of the sight glass permits reading the exact height of the top end of the rod.

Air enters at the lower left-hand opening into the chamber surrounding the dashpot cylinder and passes through ported openings into the interior of the metering cylinder, the wall of which is drilled with a large number of small, accurately reamed holes uniformly spaced. To pass to the outlet chamber the air lifts the piston and exposes some of the holes to the flow.

A small "head," or difference of pressure, is established between the interior of the cylinder and the outlet chamber; this pressure difference, only a few ounces per square inch, being fixed by the exact weight of the moving element and the area of the piston on which the difference of pressure acts. The moving element rises until the weight is exactly supported by the difference in pressure. The pistons and rod are then floating in static balance in a position corresponding exactly to the volume of air flowing, the number of holes exposed and the height of the top of rod in sight glass. It is evident that the meter automatically adjusts itself to the conditions required by the principle or natural law stated above. The divisions of the scale plate are calibrated by comparison with a standardized instrument to read correctly.

It should be noted that this is not a velocity meter which would give readings

COMPRESSED AIR METER.

proportional to the square of the volume flowing, but is a direct volume gauge with a uniform scale on which one cubic foot is represented by the same distance whether working at low or high capacity. The loss of pressure is so slight that it can not be detected by a gauge and the meter can not be injured by a flow in excess of its metering capacity There are no leather pockets, rubber or leather discs, bearings, gears, valves or other parts which can develop defects to affect the accuracy; while the use of bronze parts prevents corrosion or rusting.

The Tool-om-eter (10 to 100 feet capacity, 1 in. openings) is designed to apply to small tools, such as chipping and rivet-

ing hammers, plug, hammer and air-feed drills, wood boring and metal drilling machines, etc., rated by manufacturers at not over 60 feet per minute when new.

The Drill-om-meter (50 to 300 feet capacity, 2 in. openings) is adapted to mounted rock drills, coal punchers, diamond drills, sand blasts, air lifts, channelers, hoists, pumps, pile hammers, motors, etc., where the actual consumption is not over 300 feet per minute.

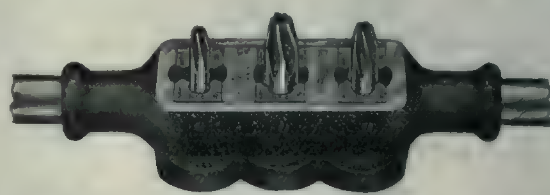
NEW ATTACHMENT FOR PIPE-THREADING TOOLS.

THE Greenfield Tap and Die Corporation, Greenfield, Mass., have recently put upon the market a new attachment for pipe-threading tools, and known as an Internal Guide with Reamer Point.

The internal guide takes the place of various forms of external or bushing guides which have been common heretofore for guiding the dies in pipe stocks for a straight thread. This new form of guide, as well as being effective in guiding the die in making its first threads, has the additional advantage of reaming the burrs from the inside of the pipe as it enters, thus doing two operations in one.

The guide is made in sizes to fit the inside of the pipe to be threaded, and, working inside the latter, allows threading on a quite short projection. With pipes cut at an angle, no difficulties are said to be experienced, as the guide does not permit the die to tip and make a crooked start. The various illustrations show the application of the internal guide to various pipe threading tools manufactured by the G. T. & D. Corporation.

DUO PIPE DIE STOCK WITH INTERNAL GUIDE.



TRIO PIPE DIE STOCK WITH INTERNAL GUIDE.

PIPE-THREADING SETS FOR CEILING WORK FITTED WITH INTERNAL GUIDE.

HIGH-SPEED STEEL DEMAND.

A MOST striking feature of the munitions of war demand is the remarkable boom in high-speed steel. In the history of the trade nothing approaching the present demand for this specialty has heretofore been experienced; in fact, the present colossal requirements have never been dreamed of. Not only are orders numerous but they are of tremendous size and value. These orders, in addition to British sources, come from Russia, France, Italy and the United States. One order received recently in Sheffield, England, from Russia amounted to 100 tons. This does not seem a large quantity when speaking of steel to those familiar with the trade, but the importance of the order can be gauged by the fact that this material is quoted by the pound and the price to-day ranges from 41 to 97 cents, as against 32 to 85 cents in normal times.

In the manufacture of high-speed steel the principal alloys used are tungsten powder of ferro-tungsten, ferro-chrome and ferro-vandium, and the supply of these alloys has failed to a great extent, which has been a further handicap to manufacturers.

Prior to the war, it is estimated that Germany supplied 90 per cent. of the tungsten used by British manufacturers, and since then this source of supply has been entirely cut off. British firms are endeavoring to supply this deficiency and expect to be able to place their products on the market by midsummer, although there is no certainty as to this. In any case it is thought the present high prices prevailing will continue throughout the year.

Ferro-chrome (4 to 6 carbon) has advanced from 30 to 35 per cent.

The price of vanadium has remained stationary, owing to the fact that almost the entire supply comes from the United States, where there is ample production.

Ferro-tungsten has advanced from 57 cents to 97 cents per pound of tungsten contained in the alloy.

Tungsten powder (from 96 to 98 per cent.) has made the phenomenal advance from 57 cents to $1.34 per pound.

In former times tungsten powder was the favorite form of wolfram used by most manufacturers. Since then, however, owing probably to the difficulty experienced in procuring wolfram in this form, ferro-tungsten is being extensively used.

FURNACE RECORD WITH DRY BLAST.

A NOTEWORTHY record was made in April by furnace B of the Steel Company of Canada plant at Hamilton, Ont. The furnace was operated with dry blast carrying an average of 0.826 grains of moisture per cubic foot, the average moisture in the atmosphere during the same period being 2.841 grains per cubic foot. The yield of ores for the month was as follows: For basic iron, 50.64 per cent.; for foundry iron, 51.55 per cent.:

Day of Month.	Product. gross tons.	Average silicon.	Coke per ton, lb.
Basic Iron.			
1	474	1.25	2016
17	445	1.09	2073
18	418	1.00	1976
19	463	1.08	1861
20	412	1.00	2151
21	473	1.09	1892
22	483	.85	1818
23	453	.95	1917
24*	418	1.05	2100
25	479	1.05	1833
26	438	1.10	1965
27*	432	.89	1914
28	463	.73	1861
29	456	.87	1925
30*	473	.64	1802
Average	452	.97	1911
Foundry Iron.			
2	326	2.71	2592
3	374	3.15	2256
4	347	3.25	2407
5	368	2.90	2200
6	371	2.31	2156
7	379	2.23	2067
8	383	2.60	2177
9	390	2.97	2140
10	389	3.16	2102
11	391	2.98	2137
12	380	3.08	2198
13	387	3.01	2201
14	418	2.63	2038
15	417	2.70	2000
16	398	2.60	2030
Average	381	2.82	2157

*Lost 38, 55, 55 min. tuyeres respectively.

According to Norwegian papers more than 300 mines have been found on the shores of the peninsula.

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Vol. XIII. MAY 27, 1915 No. 21

PRINCIPAL CONTENTS.

THE SHRAPNEL SHELL MANUFACTURING SITUATION.

SINCE our previous writing, considerable progress has been made in the installation of shrapnel shell forging equipment, but whether all or any of this will make the comparison between forging capacity and machining capacity less odious, remains to be seen. More than commensurate progress and development we are disposed to affirm marks daily the latter feature, and leads us to suggest that contracts for shell forgings should be particularized more and the scope and opportunity enlarged.

In discussing the shell forging feature relative to equipment in a recent issue, we laid special stress on the fact that while much ingenuity had been displayed in formulating and applying attachments to standard lathes, etc., for machining purposes, no serious attempt had been made to "rig up" and maintain the equivalent in forging presses and furnaces. In a word, everybody wants to do the machining, and a most astonishing feature of the every-day development relative to it is to be found in a more or less general desire by individuals singly and jointly to seek to build and equip shell machining plants. Why, we ask, don't these people grip the undertaking at the 9 ft. x $3\frac{1}{2}$ in. steel bar, and either finish at the shell forging or at the trimming of the base and cutting-off to length of the open end of shell which constitute the first machine tool operations.

Irrespective altogether of the duration of the war, we seem to have no lack of already established and easy-to-be-equipped machine shops. Besides, and as already indicated, those latter are not standing still. All over the country, but more especially of course in Eastern territary, additions and extensions are being vigorously prosecuted and new machine tools being installed. Taking the situation therefore as we find it to-day, and more particularly of course in plants which have to be supplied with forgings, much of their equipment is perhaps 50 per cent. idle each week on account of shortage of the latter. What hope then is there for those who would promote the erection of shell machining plants which have to be created from the bottom up.

The disproportion between machining and forging capacities per day, named a few weeks ago—40,000 and 23,000 respectively, represents quite fairly how our established machine shops pure and simple stand relative to shell output. It seems to us that another half-dozen single or double installations of forging presses with their accessory equipment of saws and furnaces would not be found far amiss in relief of the present and yet to be developed machining situation, and until something of that nature materializes, it seems more or less needless to discuss, much less create, brand new machine shops.

PREPARATION FOR HIGH EXPLOSIVE SHELL MANUFACTURE.

AMONG the many reasons patent and otherwise for the Imperial Cabinet shuffle now in process, lack of high explosive shells for our armies at the front appears to have more than ordinary prominence. Suffice it to say, however, that contracts for high explosive shells are being placed with our engineering and metal-working plants in number and extent as to presage much opportunity and much activity. In another section of this issue we have given in brief, racy outline a few facts relative to this new development in shell production.

It is quite apparent that for many operations on both 3.3 and 4.5 high explosive shells, new attachments, new and re-created equipment will be required, and along the lines indicated by the article referred to, more or less of a foundation may easily and safely be laid. As in the sphere of shrapnel shell manufacture, we, through the medium of our editorial columns, mean to neglect no opportunity and omit no instruction that will realize to our readers a full measure of knowledge of the very latest developments as these become available.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 45
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3.....	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain..	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill....	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 00
Copper, crucible	13 00	13 00
Copper, unch-bled, heavy	12 50	12 50
Copper, wire, unch-bled.	12 50	12 50
No. 1 machine compos'n	10 00	10 50
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel....	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings....	10 50	10 50
No. 1 brass turnings....	8 00	8 00
Heavy lead	4 25	4 25

Tea lead	3 25	3 25
Scrap zinc	8 00	8 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect May 14, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	44	....	....
½ in.	68	53	....	....
¾ to 1½ in. ..	73	58	....	....
2 in.	73	58	69	54
2½ to 4 in. ..	73	58	72	57
4½, 5, 6 in. ..	....	....	70	56
7, 8, 10 in. ..	....	....	67	53
X Strong P. E.				
¼, ⅜ in.	56	44	....	....
½ in.	63	51	....	....
¾ to 1½ in. .	67	55	....	....
2, 2½, 3 in. ..	68	56	....	....
2 in.	....	....	63	52
2½ to 4 in. ..	....	....	63	55
4½, 5, 6 in. ..	....	....	66	55
7, 8 in.	....	....	59	47
XX Strong P. E.				
½ to 2 in. ...	44	34	....	....
2½ to 4 in. ..	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	57	38	....	....
½ in.	62	47	....	....
¾ to 1½ in. ..	67	52	....	....
2 in.	67	52	63	48
2½, 3 in.	67	52	66	51
3½, 4 in.	....	....	66	51
4½, 5, 6 in. ..	....	....	63	49
7, 8 in.	....	....	60	46

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws....	65%
Sq. Head Set Screws ....65 &	10%
Rd. & Fil. Head Cap Screws......	45%
Flat & But. Head Cap Screws....	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ..	$21 00	$21 00
Electrolytic copper	20 50	20 75
Castings, copper	20 00	20 50
Tin	45 00	40 00
Spelter	18 00	18 00
Lead	5 60	5 75
Antimony	35 00	40 00
Aluminum	27 00	23 50

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh...	$20 00
Openhearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less......	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60

Machine screws, iron, brass.....35 p.c.
Nuts, square, all sizes..4¼c per lb. off
Nuts, Hexagon, all sizes.4¾c per lb. off
Iron rivets .... 72½ per cent.
Boiler rivets, base, ¾-in. and larger $3.25
Structural rivets, as above....... 3.25
Wood screws, flathead, bright ....85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass ....75, 10, 10 p.c. off
Wood screws, flathead, Bronze ....70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.75
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.82
Linseed oil, boiled, single bbls.	0.85
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.15½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 25
Apollo brand, 10¾ oz. (galvanized)	4.60	4.60
Queen's Head, 28 B.W.G.	4.75	4.75
Fleur-de-Lis, 28 B.W.G.	4.45	4.45
Gorbal's Best, No. 28	4.75	4.75
Viking metal, No. 28	4.35	4.35

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07¼
Standard	0 06¾
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 24, 1915.—Practically all the industrial activity throughout the iron and steel trade can be traced directly to the manufacture of shells and their component parts. It has long since been proven that these munitions of war can be very successfully manufactured in Canada, thus many other lines of business have been greatly stimulated.

The steel trade for instance has been benefited to a considerable extent. It is thought as the smaller shells have been so successfully turned out, that orders for larger shells will follow.

The machine tool business has never before been face to face with a similar situation. It seems that the historic words of Sir John French, "Shells and shells, then more shells," have not only been re-echoed, but have been transformed to become "Lathes, and lathes, then more lathes." Manufacturers of these specialties have been deluged with orders, business therefore is exceedingly brisk. Iron ore and pig iron are very quiet, foundries not running at more than one-quarter capacity, if running at all, in many cases. British pig is not being shipped.

In metals, a great deal of activity exists. The demand for metals in the manufacture of munitions of war has caused a great deal of fluctuation in prices. Other factors, as a matter of course, also contribute.

The Steel Market.

Although, for some time past, trade in

steel products has been fairly quiet, there seems of late to be renewed activities. Larger shells are being manufactured in Canada now and the smaller ones are being produced in tremendously larger quantities. The result is that a considerable tonnage of steel is daily cut up into billets to be forged into shells. There is, however, very little other local demand for steel. The building trade throughout the province seems to be at a standstill. Tool steel is being used in large quantities, there being a demand for it in bars and also made up into tools of various special and standard designs.

It would appear that this is a most opportune time for Canada to develop some foreign trade, were tonnage available to ship the material. South Africa, India, and Australia are in the market for large quantities of steel, but only a small quantity has been shipped to date because of the shipping difficulty. No doubt as time goes on these conditions will improve and some deals may be closed.

The railways of Canada have been buying much less steel than had been anticipated. This is due, no doubt, to there being so few trains operated because of the decrease in freight traffic.

Pig Iron.

Pig iron remains at a standstill, and it is not likely that there will be any radical change in the situation as long as the war lasts. Prices also remain unchanged.

Machine Tools.

As referred to above, the demand for machine tools has been practically unprecedented. It is to be noted in most cases that engine lathes of the heavy duty variety, are in great demand. Practically every lathe manufacturer in Canada and the United States is booked with orders for many months to come, while dealers are disposing of hundreds of second-hand machines, and others that have been rebuilt. Grinders for external work are also in more or less demand. Dealers are also stocking many jigs and attachments for equipping standard machines. Thus the volume of business moving is quite abnormal.

The supply business is excellent, belts, tool steel, waste, lard oil, cutting compounds, etc., being all in great demand. As the production of shells increases week by week, so also does this branch of the business increase.

Metals.

With probably a score or more factors to influence it, the metal market is very changeable indeed. Shipping conditions and the demand, however, play an important role in the various changes. Copper during the last week has stiffened a little but no actual increase in price has occurred. The demand is good.

Tin has taken a further jump up of three cents a pound, while spelter has gone up one cent. The demand is increasing, yet there appears to be no immediate chance of importing these commodities.

Lead is rather quiet. It seems that the demand for this metal to be made into bullets, etc., has not in any way commenced to be as great as that in times of peace, which demand has, of course, been reduced to an extremely small amount.

Antimony, although scarce, has not risen in price. This is due to the small quantities being received from over the water.

The demand for aluminum seems ever on the increase, the price being now up to twenty-seven cents per pound.

Toronto, Ont., May 25, 1915.—There is no change to note in the general industrial situation. This has been a quiet week in business circles due to the political unrest in England and the strained situation between the United States and Germany. The crop outlook continues very favorable and is helping to relieve the depression. The trade returns for April recently published show a large increase in exports over the corresponding month of last year and a considerable decrease in imports. This reversal in trade has been caused by the extraordinary conditions created by the war and although exceedingly favorable, are at the same time abnormal. These conditions will no doubt prevail for some time as orders for large quantities of war material are still being placed with Canadian manufacturers, and it is probble they will increase in volume.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Steel Market.

The situation in the steel trade is unchanged, but production is gradually increasing due largely to the growing demand for shells. The demand for steel from manufacturing interests is light and the building trade is quiet. The probability of development in foreign trade is having a tendency to produce a more hopeful feeling in the steel market. This trade is more likely to develop after the war than while it is in progress. Prices on bars, plates and shapes are firm, but unchanged.

Pig Iron.

The market is in an uninteresting condition and prospects for improvement, even within the next few months, are not at all bright. Pig iron prices are unchanged.

Machine Tools.

Good enquiry for machine tools for making shells continues, but there is no improvement as regards deliveries. The number of firms taking shell contracts is increasing and there is a corresponding demand for suitable tools. There is a good demand for second-hand tools and for the necessary tooling fixtures.

Supplies.

Supply houses report business as being brisk, in fact, better than for many months. Prices are unchanged except turpentine, which has declined 5c and is now quoted at 68c per Imperial gallon. This decline is largely due to price cutting, with a view to stimulate business.

Metals.

The situation in the metal market is unchanged. Copper, antimony and spelter are in good demand for munitions, but ordinary trade is quiet and buying is hand to mouth. The markets are at practically the same level, no changes of importance are to be noted. The spelter situation is unchanged and supplies are scarce. The antimony market is still strong and a shortage is accounted for by the heavy demand for this metal for munitions. The tin market is weak and prices are lower.

Tin.—The market is dull and quotations have a lower tendency. The posibility of a long war has had a depressing effect on the London market with a sharp decline in prices of spot tin. The New York market is quiet and weaker. Tin has declined 2c in the local market and is now quoted at 40c per pound.

Copper.—The copper market declined in London on account of the unsettled political conditions. The New York market is steady but very dull, although exports of copper are increasing. Local quotations are unchanged at 21c per pound.

Spelter. — The market is excited and very strong. The demand continues heavy with spot metal very scarce and futures well sold up. The situation is serious and judging from present outlook is liable to get worse. Spelter has advanced 1c locally and quotations are nominal at 18c per pound.

Lead.—The market is firm but very quiet. Local quotations are unchanged at 5¾c per pound.

Antimony.—The market is quiet and quotations unchanged. The antimony position is a strong one and the heavy demand for this metal for munitions continues. Local quotations are nominal at 40c per pound.

Aluminum.—The market is strong and prices nominal. The demand is becoming greater than the supply, and higher prices are anticipated. Quotations are unchanged at 23½c per pound.

ORGANIZED DEVELOPMENT OF CANADIAN EXPORTS.

ANNOUNCEMENT is made that plans whereby Canadian manufacturers and producers should have opportunity to push their wares in the world's markets have taken definite shape. Application is being made for a Federal charter for a company to be incorporated with an authorized capital of half a million dollars. Provisional directors have been named and managers appointed. The company is to be known as the Export Association of Canada, Limited, and the head office will probably be in Montreal.

To Operate on Broad Lines.

It is intended that the company shall operate on broad national lines, and while the leading part in its formation is being taken by prominent members of the Canadian Manufacturers' Association, it is not proposed to limits its activities to the handling of manufactured goods, but to operate on the broadest possible basis.

The possibilities of such an organization are enormous, and if carried through successfully should have a most beneficial effect on all Canada. One of the serious factors in the industrial life of Canada has been the restricted market spread over a wide area, which made selling expenses high and added to the percentage of overhead costs. The working up of a large export trade on a permanent basis will at the same time reduce the average cost and add to the employment of labor.

Provisional Directors.

The provisional directors appointed are: J. H. A. Acer, Laurentide Co., Montreal; G. F. Benson, Edwardsburg Starch Co,, Montreal; C. N. Candee, Gutta Percha & Rubber, Ltd., Toronto; G. H. Duggan, Dominion Bridge Co., Montreal; H. L. Frost, Frost Wire Fence Co., Hamilton, Ont.; C. B. Gordon, Dominion Textile Co., Montreal; R. H. McMaster, Steel Co. of Canada, Ltd., Montreal; W. W. Near, Page-Hersey Iron Tube & Lead Co., Toronto; J. H. Sherrard, Alaska Feather & Down Co., Montreal; A. W. Wheatly, Canadian Locomotive Co., Kingston, Ont.

General Managers Appointed.

The provisional directors have arranged to secure the services of F. C. Armstrong, of London, England, and R. J. Younge, of Montreal, to organize the association, and afterwards for the first year of operations to act as joint general managers.

Mr. Armstrong, who will have charge of the offices outside of Canada, is a Canadian by birth, and has had a wide experience in foreign trade. During the past fifteen years he has carried out important undertakings abroad on behalf of British interests with whom he was associated, and has thus had an opportunity of studying at first hand the various countries in which the association may expect to find a market for Canadian goods.

Mr. Younge (of R. J. Younge & Co.), who will direct the Canadian office, was for several years general secretary of the Canadian Manufacturers' Association, and is known personally to the leading manufacturers of the Dominion.

Purpose of the Company.

Briefly stated, the object of the Export Association of Canada, Ltd., is to provide an organization to secure for Canada a new and larger portion of the world's trade under the changed conditions brought about by the war, and to develop and carry on the export trade in Canadian products upon national co-operative lines. Assurances have been given of co-operation by the Dominion Government, the railways and large manufacturing interests for the proposed organization.

Its functions will be: First, to create a favorable strategical position in foreign markets for Canadian industry as a whole; second, to do the work of a commission agent in the sale of Canadian goods in the countries where its branches are established. It should as well be able to render important services in connection with arrangements for overseas transport and for banking facilities necessary for foreign trade. The activities of the association will not be restricted to manufactured goods, but also embrace the assistance of trade in agricultural and natural products.

Proposed Organization.

The head office of the company will probably be in Montreal and will work in close connection with the Canadian Manufacturers' Association and other Canadian producers, in whose interests the export campaign is to be developed. This office would be so organized as to be able to deal effectively and promptly with all the situations arising from the developing relations between the manufacturers, on the one side, and the foreign branches and their customers on the other.

In its relations abroad the association would aim in the first place at utilizing and strengthening the position of already existing organizations which have developed trade within the Empire, and notably with New Zealand, Australia and South Africa.

Office in London.

In the second place it is intended to open at once an office in London, England., to assist in securing favorable consideration for Canadian trade in all directions where Governmental assistance can properly be requested, or the influence of financial houses interested in the prosperity of Canada can effectively be brought to bear. Its functions will also be to connect up Canadian manufacturers with all the great purchasing and distributing agencies, both Governmental and private, which make London their headquarters.

Attention will be directed to the French and Belgium markets which will open up, particularly during the reconstruction period, and also to the immense Russian market opening up for manufactured goods of all kinds. Further extensions of the activities of the association to markets such as those of South America, India and the Far East will be made from time to time, as the opportunity seems favorable and the resources of the association permit.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

Tender forms, specifications and drawings have been forwarded by D. H. Ross, Trade Commissioner, at Melbourne, for equipment required by the Victorian railways. These tender forms have not yet come to hand, but when received they may be inspected by interested Canadian manufacturers at the Department of Trade and Commerce, Ottawa (refer File No. 1435). Particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:

Victorian State Railways, Melbourne.

No. 28,759. July 14.—100 tons white lead in oil.

No. 28,811. July 14. — 60,000 flame arc carbons.

No. 28,817. July 14.—11,880 feet aluminum feeder cable.

No. 28,817. July 14. — Sundry aluminum fittings.

No. 28,822. July 14.—125 tons steel channel bars (as per drawing).

The departure of mails from Vancouver are indicated as follows: From Vancouver, June 9; due Melbourne, July 3.

ONTARIO MINERAL PRODUCTION.

THE production of gold, nickel and iron ore in Ontario increased during the first three months of the year, but the output of silver, copper, pig iron, cobalt, and cobalt and nickel oxides substantially decreased. The drop was most noticeable in silver and pig iron, the decrease in the former being about 30 per cent.

and in the latter 50 per cent. The increase in the production of gold amounted in value to $365,541, the total for the quarter being $1,568,043.

Low prices of silver and the shortage of water for power purposes, which impeded operations, are chiefly responsible for the fall in silver production, although the exhaustion of some properties which formerly produced freely was a factor. There is little demand for iron ore, which explains the drop in output, and the war has shut off all exports of oxides to Europe. On the other hand, the war has boomed the nickel industry, and all mines are being worked to full capacity.

The following are the comparative figures for the quarter:

	1st 3 months.	Decrease.
Gold	$1,568,043	*$ 365,541
Silver	2,488,909	1,060,647
Copper	526,338	65,650
Nickel	1,496,622	*50,610
Iron ore	50,592	*37,664
Pig iron	1,158,462	1,344,088
Cobalt	3,718	5,180
Cobalt and nickel oxides	19,686	149,279

*Increase.

OPENING FOR NAIL WIRE IN AUSTRALIA.

AN opening for trade in Australia is in the supply of wire for making nails. All supplies at present are received from the United States. American nail wire is found most suitable, not only for the nail itself, but for the nail-making machine.

Some years ago English wire was tried, but did not suit, and then a trial was made with German, with like results. Moreover, from the similarity of the English and German wires it was judged that the English wire was drawn from German rods. The English wire, it is stated, disarranged the cutters of the machine, and the head stampers also, more frequently than the American. The machine needed to be set from two to six times a day with the English wire, whereas with American wire adjustment is necessary only once every two or three days. This means not only loss of time, but expenditure in labor for sharpening the cutters. The consumption of nails is enormous.

One of the two factories in Sydney never allows its stock of nail wire to get below 200 tons. Even in a brick building there is a considerable quantity of nails used for flooring, but in weather board houses the consumption is enormous, and practically all the houses in the country and a fair proportion in the cities are of weather board. The trade is worth capturing.—C.C. Journal.

Brig.-Gen. Bertram, chairman of the Shell Committee, has, we understand, confirmed the statement that negotiations are now under way for the establishment of a copper refining plant in Canada. He stated that although nothing has been as yet settled, it was likely the plant would be situated at Trail, B.C., in close proximity to the works of the Consolidated Mining and Smelting Co.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Oakville, Ont.—The Oakville Basket Co. contemplate purchasing a steam engine.

Deer Lake, Ont.—The Cordova Mines Co. may purchase an air compressor plant.

Owen Sound, Ont.—The McQuay Tanning Co. will buy extra power plant equipment.

Niagara Falls, Ont.—An aerial tramway will be constructed across the whirlpool.

Amherst, N.S.—The Canadian Car & Foundry Co. will instal a shell forging plant here.

Prescott, Ont.—The Prescott Emery Wheel Co. has received an order for lyddite shells.

Brighton, Ont. — Extensions will be made to the D. J. Barber Co. foundry at this place.

Calgary, Alta. — The Buckeye Machinery Co. of this city has been awarded a contract for 20,000 shells.

Sarnia, Ont.—The Loughead Mfg. Co. of this city has received an order for another 100,000 shrapnel shells.

St. John's, Nfld.—It is reported that the Reid Co. will shortly engage in the manufacture of shells.

Medicine Hat, Alta.—The local plant of the Saskatchewan Bridge and Ironworks may be reopened shortly.

Quebec, Que.—L. H. Gaudry, president of the Eastern Canada Steel Co., has obtained an order for 70,000 shells.

Dutton, Ont.—The Dutton Electric Light Co. have decided to sell their plant, as hydro power will soon be installed here.

Walkerville, Ont. — The Canadian Stamping Co., is breaking ground for a new forging plant 600 ft. long. It will be equipped with the most modern machinery and appliances.

Hamilton, Ont.—It is understood that an American firm has practically decided to open up a factory here for the manufacture of locks, bolts, hammers, hatchets, iron randles, etc.

Victoria, B.C.—The following local firms have got contracts for shells: Yarrows, Ltd., Victoria Machinery Depot, Hutchinson Bros., Ramsay Machine Works, and the Hafer Machine Works.

St. Thomas, Ont.—A company has been organized here for the purpose of manufacturing shrapnel shells for the Canadian and British Governments. A part of the plant of the St. Thomas Steel Vault Co. has been leased. Y. A. Kilpatrick, of Toronto, is interested.

Shells for the Allies.—The Dominion Wheel & Foundry Co., Toronto, have applied to the city architect for a permit to erect a $7,500 addition to their factory on Eastern avenue. The new addition will be devoted entirely to the manufacture of high explosives for the Allies.

Trade Gossip

Calgary, Alta.—A company is now being organized to operate a large abattoir and packing plant at Calgary.

St. John's, Nfld.—Machinery to be used in the equipping of a building for a wireless station is now being conveyed to the selected site, Mount Pearl, St. John's West.

The Sudbury Construction & Machinery Co., Sudbury, Ont., have bought a 2½ ton refrigerating planter from the Vilter Mfg. Co., Milwaukee, Wis.

Hamilton, Ont.—A. C. Daun, general manager of the Oliver Chilled Plow Works, announced recently that owing to shortage of material, the company had found it necessary to close down for 30 days.

The Vilter Manufacturing Co., Milwaukee, Wis., have sold the following refrigerating plants to the Borden Condensed Milk Co:—14-ton plant to the Norwich factory; 25-ton plant for Tillsonburg, Ont., and a 24-ton plant for the factory at Ingersoll, Ont.

Windsor, Ont.—An appropriation of $2.000 will be made by the city council to aid in a campaign for more industries for Windsor if the recommendation of the transportation and industrial committee is approved.

Vancouver, B. C. — The British Columbia Mills, Timber and Trading Co., owners of the Hastings Sawmills, have received an order for some 10,000,000 feet from the British Admiralty, according to an announcement made recently by Eric Hamber, the vice-president and general manager.

C. Ross Cameron, sales manager the Wm. Hamilton Co., Peterborough, Ont., has resigned his position to go to the front as lieutenant in the machine gun battery, 3rd contingent. G. R. Munro, chief engineer will assume the duties of sales manager in addition to those of his own department.

Ross Rifle Output.—We understand that due to the improvement and enlargement of the Ross Rifle Factory at Quebec, some 1,500 rifles per week are now being regularly turned out. The British War Office is reported to have placed a large order for this Canadian made and Canadian service arm, and due to our own and the above require-

ments, a large order from the Russian Government has meantime been refused.

Tank Steel Inquiry.—The department is in receipt of a cable from J. E. Ray, Dominion Trade Commissioner at Birmingham, England, calling attention to an inquiry for 3,000 tons of tank steel sheet. It is stated that urgent quotations are desired. The size required is six millimetres by a thousand millimetres and may be of any length most suitable for the work. Prices should be c.i.f. a Russian port. Manufacturers are required to state the earliest date on which they can make delivery.

Canada's Coal Output.—Coal formed more than one-fourth of Canda's total mineral output in 1914. The Dominion production of marketable coal in that year amounted to 13,594,984 short tons, valued at $33,433,108 as against 15,012,178 tons, valued at $37,334,940 in 1913. British Columbia's output totalled 2,238,339 tons in 1914, a decrease of 476,081 tons, while that of Yukon Territory was 13,443 tons, a decrease of 6,279 tons.

Intercolonial Railway.—The Intercolonial Railway is spending nearly $3,000,000 this year on equipment. This includes 12 super-heat equipped locomotives, 10 Pacific type locomotives, 6 consolidated locomotives, 4 switching locomotives, ballasting equipment and rail loaders, 200 steel flat cars, 250 steel gondola cars, 4 light wrecking cranes, 8 sleeping cars, 4 steel sleeping cars, 4 baggage cars, 2 postal cars, etc. Some of this equipment has already been delivered and placed in service.

Prince Rupert, B.C. — The last pontoon for the Grand Trunk Pacific dry dock was launched recently. The dock and shipbuilding plant will be ready, with a complete complement of machinery for ship repairs, by August 1. The oil tank equipment at Prince Rupert is also completed and a few days ago the first oil-burning locomotive brought train No. 1 into the Pacific Terminal. In a short time over the whole of the Grand Trunk Pacific line from Jasper westward will be operating with oil-burning locomotives.

After Skilled Labor. — George N. Barnes, Labor M.P., and secretary of the Amalgamated Society of ngineers, and W. Wyndham, permanent official of the labor exchange department of the Board of Trade, are coming to Canada on the Adriatic to make enquiries concerning suitable skilled labor for the war munition factories in Great Britain, The Board of Trade understand that there is some unemployment even among skilled artizans in Canada, and if this is so, the delegation will proceed to Ottawa to confer with Sir George E. Foster, and will also visit large employers of labor.

Canadian Trade Returns.—An increase of $10,000,000 in Canada's trade during April over the corresponding month last year is shown by figures just issued. The total trade last month was $65,000,000. Exports of manufactured articles were valued at $13,000,000 compared with $4,000,000 for the same month in 1914, while exports of merchandise totalled $28,691,000 as against $17,751,000 for April of last year. While exports increased, imports decreased considerably, totalling $28,391,000 as against $36,937,000 for April, 1914, the duty realized being $5,986,000 compared with $6,458,000 for the corresponding month of last year. Of the exports that of animals and their produce bulked largest, being $3,312,000 compared with $1,860,000 in 1914.

No Morgan Monopoly.—In the Briish House of Commons, on May 19, Harold Baker, Financial Secretary of the War Office, stated that the existing contract between the British Government and the firm of J. P. Morgan Co., of New York, does not debar the giving of business to other firms in the United States, should circumstances make such a course advisable. This announcement was made in answer to a question asked by Sir Richard A. Cooper, who wanted to know if firms in America which declined to negotiate with or through the Morgans were still able to supply Great Britain with munitions of war. Mr. Baker said: "The War Department is free to place orders with any firm in United States, and will do so on any proper occasion."

Municipal

Owen Sound, Ont.—Council will raise $10,000 for new water mains. R. McDowell, town engineer.

Toronto, Ont.—The city will install an Imhoff tank on the Morley Ave. disposal plant at a cost of $12,000.

Montreal, Que.—The town council of North Montreal will install a sewerage purification plant. F. C. Laberge, Montreal, engineer.

Kingston, Ont.—The city council has decided to erect the proposed incinerator next to the power plant on Barrack St. R. J. McClelland, city engineer.

Rodney, Ont.—A by-law will be submitted in the near future to authorize a grant of $5,000 for a term of 10 years to the Rodney Woodenware Co.

Outremont, Que.—The town council has decided to municipalize the street

lighting system. The question of abolishing poles and overhead light wires is also to be considered.

Regina, Sask.—The council have under consideration the expenditure of $75,000 on waterworks improvements; $30,000 on power-house equipment and $16,500 for sewage disposal works.

Sydney, C.B.—The city engineer's office has completed the plans for the new Middle Lake pumping station and it is expected that tenders will be called for the work in a very short time.

Personal

Thomas Smith, of Toronto, has been appointed an inspector of shells by the Dominion Government.

George H. Greenfield has been appointed plant engineer of the Canadian

THE LATE MAXIMILIAN EUGENE DUNCAN.

Car & Foundry Co., with headquarters in Montreal, Que.

Lieut. Richard G. Crawford, of the P. P. C. L. I., former president of the Windsor, Essex & Lake Shore railway, and only son of Mr. and Mrs. W. C. Crawford, of Tilbury, Ont., succumbed to wounds received in a recent battle in France.

Maximilian. Eugene Duncan, Vice-president and general manager of the Canadian Car & Foundry Co., died last Sunday at his home, in Montreal, as a result of a hemorrhage of the brain. Mr. Duncan was born in New York city on March 28, 1862. He joined the executive of the Canadian Car & Foundry and its subsidiary companies three years ago this month. Previous to com-

ing to Montreal he was general sales agent of the American Car & Foundry Co., at St. Louis, Mo.

Walter Dowker Beardmore, head of the firm of Beardmore & Company, passed away on May 23, in his 66th year, at 50 Crescent Road, Toronto, Ont. The late Mr. Beardmore was born in Hamilton in 1849, the eldest son of the late George Lissant Beardmore, and received his education in England and at Upper Canada College. His father established the business from which developed the concern now known as Beardmore & Company, tanners and leather merchants, one of the largest firms of its kind in Canada, having houses in Toronto and Montreal, and tanneries in Acton and Bracebridge. Besides being president of Beardmore & Company, the deceased was a director of the Mutual Life Association, president of the Dominion Lumber Co., the Muskoka Leather Co., the Acton Tanning Co., and the Beardmore Belting Co.

Tenders

Peterborough, Ont.—Tenders are being called until May 31 for an auxiliary pumping unit. Full particulars may be obtained from S. R. Armstrong, secretary Utilities Commission.

Hull, Que.—Tenders will be received up to June 7 for the supplying of waterwheel, electric generator and centrifugal pumps. Specifications and plans may be obtained at the office of the city engineer, J. P. A. Laforest.

London, Ont.—Tenders will be received up to June 2 for a modern combination chemical and hose car, equipped with one 40-gallon tank, and having capacity for carrying 1,200 feet of 2½-inch hose. Full information will be furnished by Fire Chief John Aitken.

Montreal, Que.—Tenders will be received up to Monday, June 7, 1915, for the construction of west extension grain elevator No. 1, Harbor of Montreal. Conditions upon which copies of the plans and specifications may be obtained will be furnished upon application to F. W. Cowie, chief engineer.

Ottawa, Ont.—Tenders will be received up to July 1, 1915, for the manufacture, supply and erection of a 30-ton steam wharf crane, of the derricking jib type, for Halifax, N.S., dockyard. The specifications and conditions of contract may be seen at the office of the consulting naval engineer, Ottawa.

Winnipeg, Man. — Tenders addressed to the Chairman, Board of Control, will be received up to Saturday, June 5, 1915,

for the manufacture, delivery and erection in the generating station at Point du Bois of one 150 k.w. motor-generator exciter set. Instructions to bidders, specifications and form of tender may be obtained at the office of the City Light and Power Department, 54 King street, Winnipeg.

Wallaceburgh, Ont.—Tenders will be received by the town clerk until Tuesday, June 1, 1915, for the following works: Contract "A-1"—laying water mains; "A-2"—laying sewers; "O"—Laying sewer force mains; "P"—constructing sewage pumping stations; "T" — constructing electric transmission line. Plans and specifications may be seen at the office of Chipman & Power, engineers, Mail Building, Toronto, or at the resident engineer's office, Wallaceburg.

Contracts Awarded

Welland, Ont.—At a special meeting of the town council last Friday night, the tender of the Star Electric Co. of Newark, N.J., for the fire alarm system at the price of $4,926 was accepted.

Woburn, Ont.—Scarboro' township council has awarded a contract for a bridge near West Hill to the Sarnia Bridge Company. This additional work will bring the cost of the bridge up to $2,200. It will have a 70-foot span.

Montreal, Que.—Estey Bros. Co. of this city have secured the contract for the ornamental iron and bronze work on the Sun Life Building, Montreal.

Toronto, Ont. — The following contracts have been awarded by the Board of Education, in connection with the new administration building: Structural steel, Dominion Bridge Co., $14,590; fireproof floors, Jas. A. Wickett, $6,957; plumbing, heating, etc., the John Ritchie Co., $13,800. Other tenders bring the price of the whole building up to $106,307.

General Industrial

Sarnia, Ont.—F. A. Gordon of this city may build a flax mill at Petrolia. Gas power will be used.

Raymond, Alta.—It is reported that an elevator will be built here by one of the largest grain companies in this province.

St. Thomas, Ont.—The Canadian Smallwares Co. plant, which was recently destroyed by fire, will be rebuilt. R. H. Dowler is interested.

Fenelon Falls, Ont.—Thomas Hodgson late manager of the Wood Products Co., Donald, Ont., is associated with a

syndicate who propose to build a chemical works here.

Alvinston, Ont.—The Alvinston Flax Mill will resume operations after standing idle for some years. A large amount of acreage has been secured by John Irving, the local manager.

Peterborough, Ont.—It is rumored that a well-known Berlin business man is making arrangements for the erection of a large up-to-date factory building on the corner of Cedar and Elgin streets.

Goderich, Ont.—The ratepayers of Goderich carried a by-law to assist the North American Chemical Co., to extend their salt plant here by granting exemption from taxation and by furnishing electric power free of charge. The vote polled was a comparatively small one, 463 being in favor of the by-law and 75 being opposed to it.

Building Notes

Oshawa, Ont.—Tenders are being called for a public school. Ellis & Ellis of Toronto, are the architects.

Vancouver, B. C. — The proposed armory at Grandview will be 225 feet by 120 feet. Major C. B. Fowler, of this city, is the architect.

Outremont, Que.—The Catholic School Board propose building a school to cost $200,000. A permit has been granted by the town council.

St. John's, Nfld. — The Commercial Cable Co. will erect an office building here to cost $80,000. W. T. Ellis is the general contractor.

London, Ont.—Members of the medical faculty of the Western University have inaugurated a campaign to obtain funds for the erection of a new medical school building to cost $100,000.

Ingersoll, Ont.—Architect Nicholson, of St. Catharines, is preparing plans for a new school. Alternative proposals call for an expenditure of $36,000 to $85,000.

Toronto, Ont.—It is announced that a new theatre will be built here to replace the Princess Theatre recently destroyed by fire. Howard Crane, of Detroit, Mich., is the architect.

New Incorporations

The Aetna Chemical Co. of Canada, Ltd., has been incorporated at Ottawa with a capital of $1,800,000 to manufacture cordite, lyddite, turpinite, nitroglycerine, trinitrotoluol, and other explosives.

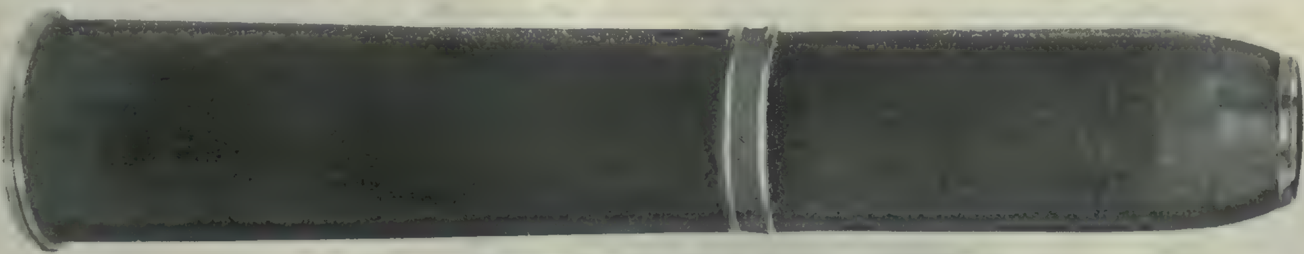
Impromptu Production of Shell Cartridge Cases

Staff Article

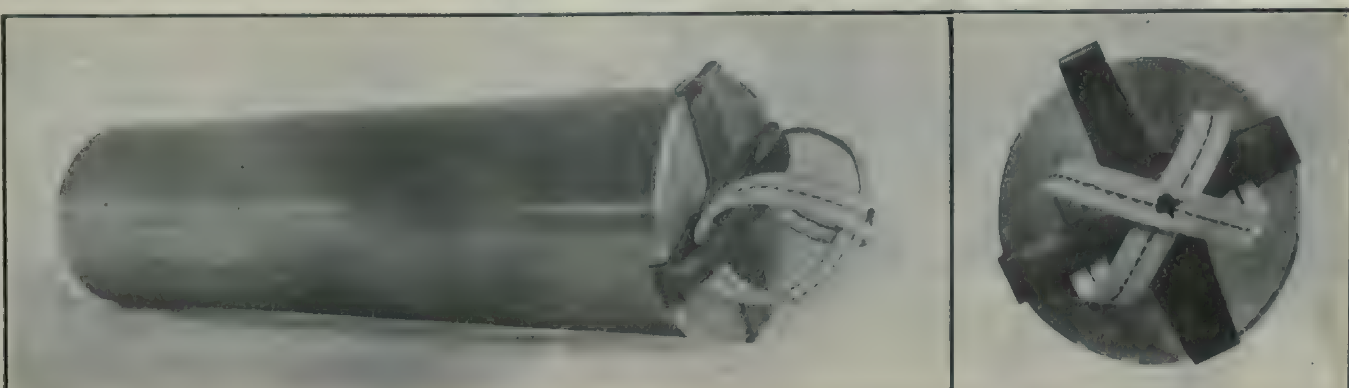
In addition to the manufacture of shrapnel and high explosive shells, there is also being undertaken in our midst the production of the accessory brass cartridge cases for these respective and meantime highly useful and necessary commodities. The accompanying illustrations and description refer in their entirety to the methods and devices employed and the equipment adaptation found in the motive power department of one of our leading railroad corporations. It will be easily apparent from perusal of the data that ingenuity of no mean order has been displayed and relative success achieved.

TO-DAY, while there are upwards of two hundred Canadian machine shops engaged in the manufacture of shells of various kinds, the number of concerns manufacturing the brass cartridge cases can perhaps be counted on the fingers of one hand. This industry will, no doubt, however, soon occupy a larger portion of our attention than it does to-day. Up until the present there has never been a demand for cartridge cases in Canada, hence there was no machinery designed or installed especially to serve this particular purpose. In the shop which this article is intended to describe no special equipment has been purchased to carry out cartridge case work, and for that reason the tools, dies, fixtures, and machines are all the more interesting. This is true not only from their educational value to the men engaged in the business, but because their very nature is so ingenious that the interest of every mechanic and engineer, even though engaged in work of a vastly different character, is attracted.

The elaborate system of dies and punches fitted up on bulldozers, planers and hydraulic presses have been most carefully designed and delicately made. However, the varying natures of the machines to which they have been attached verily causes us to hold up our hands in wonder and astonishment. These machines, which in times of peace, have been employed exclusively in railway work, are indeed now contributing to a page in Empire history. Our engineers and shop superintendents have risen to the occasion in developing tools and in designing machines and equip-



CANADIAN-MADE 18-POUNDER SHRAPNEL SHELL AND CARTRIDGE CASE.



CARTRIDGE CASE WITH DRAWING CLIP ATTACHED.

This clip is one of the incidentals being made in Canada for the British Government and forms an interesting job of blanking, piercing and drawing.

ment, and the successful outcome shows them to be as resourceful and ingenious as those of the older and perhaps more highly developed countries.

Quality of Brass.

Whether manufacturing the short cartridge case for the howitzer or the long case for the shrapnel, an extended series of drawing-out processes is required and between each drawing-out operation, annealing must occur to restore to the metal the ductility which the draw has destroyed. The composition of the brass can be roughly stated as being two parts copper and one part zinc. This metal possesses very high tensile strength when annealed and of the proper hardness. It is received in large sheets or plates of .380 of an inch in thickness. In this shop two types of cartridge cases are made. The first type is for the 18-pdr. shrapnel shell which is being manufactured in Canada today on a larger scale than that of any other. The second cartridge case is the case for the 4.5 howitzer. In this article both cases will be dealt with, the operations on the 18-pdr. shrapnel cartridge case being followed out in the first instance.

18-pdr. Shrapnel Cartridge Case—First Operations.

The first operation is to punch out from the plates of .380 thickness round discs of diameter 6.22 inches. These plates then pass to the cupping or second operation. This cupping operation is done on a motor-driven Williams & White, Moline, Ill., bulldozer, which is shown in Fig. 1. As will be seen, there are three punches fitted to the frame,

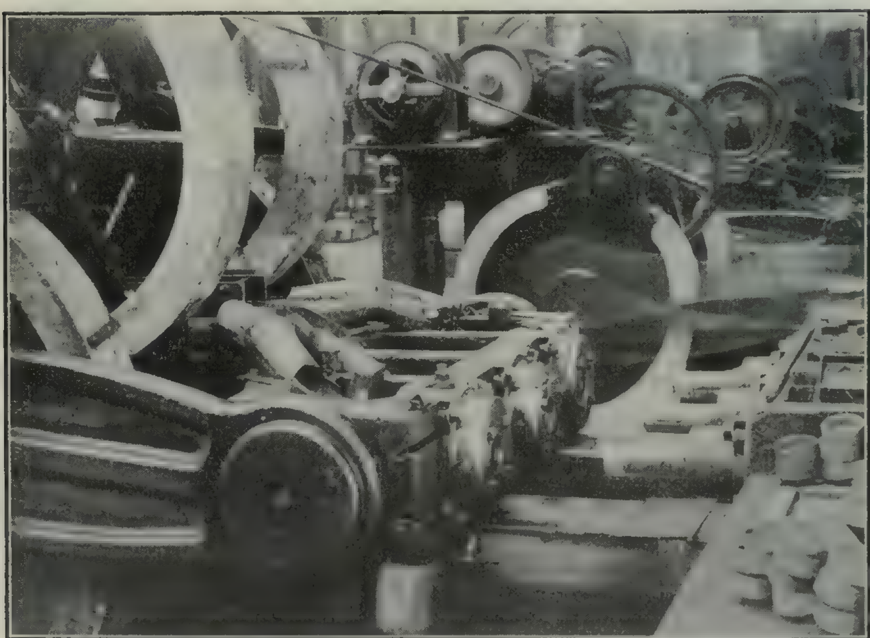
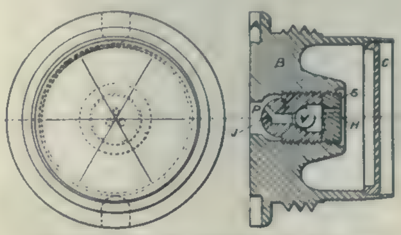


FIG. 1. BULLDOZER WITH THREE SETS OF DIES AND THREE PUNCHES FOR CUPPING AND MAKING THE FIRST DRAW ON 18-PDR. SHRAPNEL SHELL CARTRIDGE CASES. NOTE CONVEYER TUBES FOR CARRYING CASES TO REAR OF MACHINE.

while the three sets of dies are on the travelling carriage of the machine. The central punch performs the cupping operation. Fig. 2 shows the nature of the dies and punch which cup the disc. The dies, as will be seen, are bevelled



FULL-SIZE SECTION OF BRASS PERCUSSION PRIMER.

at an angle of 45 degrees to facilitate the entry of the disc therein. It will be noted that there is a small air vent in the punch which allows any trapped air to escape, and thus prevents wrinkles in the cupped disc. For similar reasons, practically all the punches are equipped with these air vents.

By referring to Fig. 3, the dimensions of the cupped disc are plainly seen. The dies and punch are covered with mineral tallow, which has been found to be about the best lubricant for this work. The third operation is annealing. The cupped discs are placed in boxes at the rear of the machine, whither they are conveyed by the motion of the punch. Immediately upon leaving the dies, the cases slide into a galvanized iron conveyor tube, and, as the punch comes through the dies, it pushes the cups along the tube with each stroke. They are pushed into a wooden shute at the rear of the machine and slide into boxes at the rear of the bulldozer. These boxes are put on trucks, which run on the standard gauge tracks throughout the shops, and are thus carried to the blacksmith shop, where the huge annealing furnaces are situated. The furnaces are of the oil-burning type, built in the shops of the company. One of these furnaces is shown in Fig. 4, and each furnace is equipped with a Bristol pyrometer. The iron baskets which serve to hold the cartridge cases are seen plainly, as the workmen are in the act of drawing out a basket.

As the trucks are wheeled beside the furnaces, men unload the cartridge cases from the boxes into the iron baskets and put these baskets of cartridge cases into the furnaces at the opposite end to that from which they are removed. The temperature at which the cartridge cases are annealed immediately

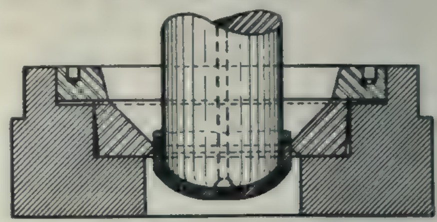


FIG. 2. CUPPING DIES.

after cupping is 650° C., or 1,200° F. They are left in the furnace for thirty-five minutes. They are then pulled out by long bars with hooks on the ends. An air hoist next picks up the basket and conveys it to a tank of water, where it is immersed and cooled.

It may here be said the effects of the annealing are in no way lost by the rapid cooling of the brass. It is, therefore, of no special benefit to cool the cases slowly, and thus, as time is one of the greatest factors in this work, the quick cooling by the immersion in a tank of water gains time and facilitates the rapidity of production. The annealing, of course, leaves a certain amount of scale on the case, which must be removed before any drawing operations are done, as this scale would ruin the punches and dies very quickly. In consequence, the fourth operation is to place the cases in an acid bath, which consists of a weak solution of muriatic acid. The shells then pass on to a hot bath of water in which some washing soda has been introduced. This latter bath removes all traces of the acid and leaves the metal clear of scale. After each annealing operation a similar wash must be given the cartridge cases.

First Drawing Operation.

The shell now passes to the fifth operation, which consists of the first of a series of six drawing operations. This first drawing operation is done on the same Williams & White bulldozer as is shown in Fig. 1. The two outside

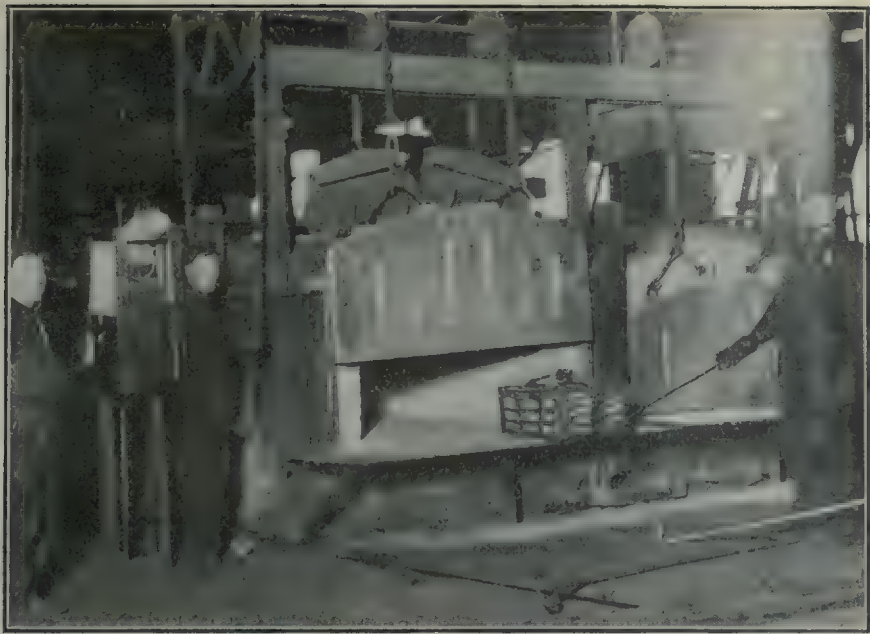


FIG. 4. FURNACE IN WHICH CARTRIDGE CASES ARE ANNEALED. THE BASKET CONTAINING THE RED HOT CASES IS BEING REMOVED FROM THE FURNACE AFTER ANNEALING.

punches work into the drawing dies that accomplish this operation. The dies and punch are shown in detail in Fig. 5, the dies being bevelled to an angle of 15° only to admit the case. By referring to Fig. 3, the size of the case and its shape can now be seen. The outside and inside diameters of the case are 4.31 inches and 3.873 inches respectively, while the over-all length is approximately 3.45 inches. Tallow and oil are placed on the work as lubricants, while the tools are copiously covered with soap and water. As in the case of the cupping operation, the punches push the cases clear of the dies and slide them into galvanized iron tubes, which convey them up to the wooden shutes at the rear of the machine. These shutes deliver the cases into boxes, which are placed on trucks and they carry them to the next operation.

Sixth and Seventh Operations.

The sixth operation is the annealing of the cartridge cases again. Each drawing operation seems to rob the brass of its ductility, hence to restore this ductility and prepare the shell for the succeeding drawing operations the case must be annealed. The cartridge cases are placed on trucks and again carried to the blacksmith shop annealing furnaces. They are placed in similar iron baskets as before, and are annealed for a period of thirty-five minutes at a temperature of 650° C. or 1,200° F. As in the previous cooling operation, tanks of water are employed, after which the shells are carried back to the cartridge shop to have the second

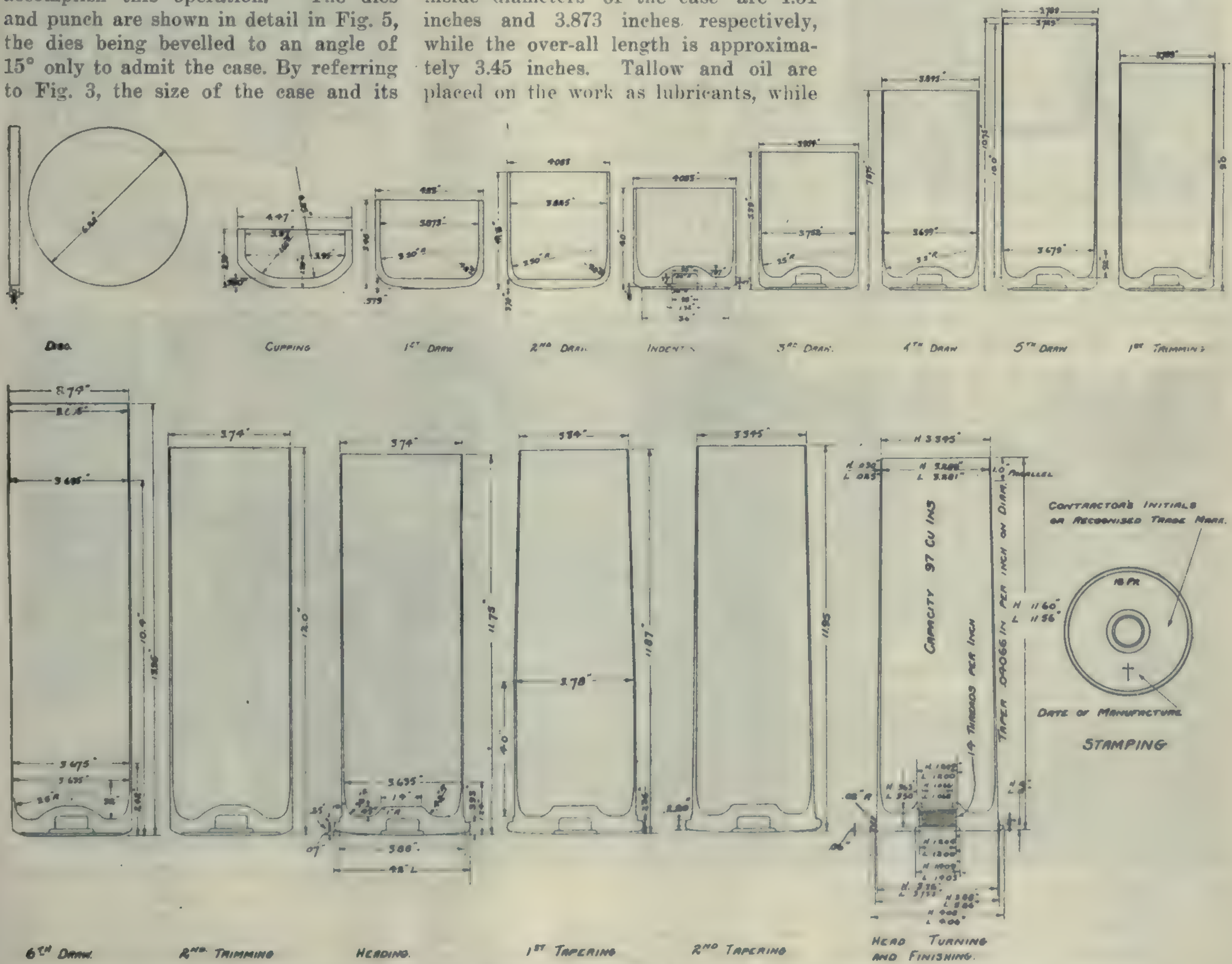


FIG. 3. CARTRIDGE CASE FOR 18-PDR. Q.F. IN ITS VARIOUS STAGES OF MANUFACTURE.

drawing operation accomplished after washing the cases. This drawing is done on a Williams & White bulldozer, but on a smaller machine than that on which the cupping and first drawing opera-

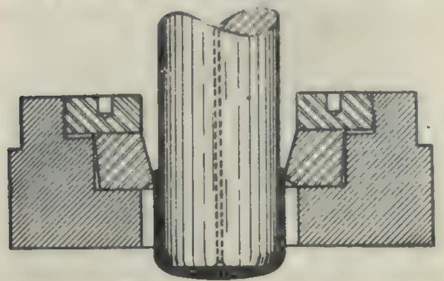


FIG. 5 FIRST DRAW.

tions were done. The machine is, however, fitted up with dies and punches similar to those shown in Fig. 1. The details of the dies and punch are shown in Fig. 6. As will be seen here, these

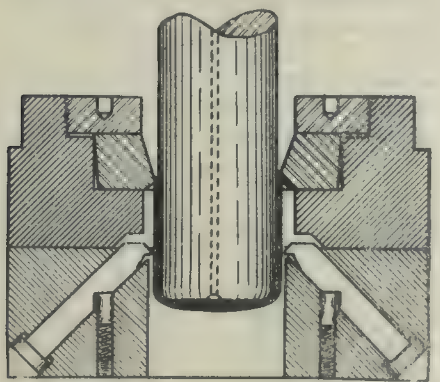


FIG. 6. SECOND DRAW.

dies are also bevelled at an angle of 15° to facilitate the entry of the shell. The same lubricants as in the first draw are used. The case is so long now that stripping jaws have to be used to pull it from the punch. All of the cases are collected from the rear of the machine as before and transported to the blacksmith shop to be indented. The outside and inside diameters of the case are now 4.083 inches and 3.825 inches respectively, and the length is approximately 4.6 inches.

Indenting (Eighth Operation) and Annealing.

The next operation is that of indenting. It was formerly the practice to make a first and second indenting, but this idea has now been abandoned, and all is done in one operation. The work is done on a 500-ton hydraulic press, the pressure being obtained from a motor-driven vertical triple Aldrich pump. The pressure head on the delivery line is 1,500 feet, which corresponds to a little over 650 pounds per square inch. Water is pumped into a huge accumulator.

The details of the dies are shown in Fig. 7, while Fig. 8 shows the 500-ton press on which the indenting is accomplished. No lubricant is used on the dies or the case. The punch is held in the stationary portion of the press, and on the table attached to the ram are placed the dies. This table revolves, and is located for pressing at every quarter turn. The central die is pushed into position by a lever at the first position and is forced up into the cartridge case. As soon as this is done, the table is revolved by hand for one-quarter turn, and the moment the table revolves its stationary part comes under the central die and holds it in place. After a quarter has been traversed, a stop locates the table in position for another cartridge case to be placed in the dies. This done, another quarter turn of the table is made, and here the whole table is raised by the water pressure of the hydraulic ram. The punch causes the indentation to be made in the case. The table is now lowered and given another quarter turn, then raised again, thereby causing the cartridge case and central part of the die to be pushed out by a fixture on the stationary head of the press. The central portion of the die is passed on to be again placed in position to indent another case.

A case is placed in the dies, one indented and one pushed out every raise of the table, thus the press requires three men to operate it. One man places the cases in the dies, one man operates the water, and the third man takes the cases from the dies. Only one press is engaged in this work. The cases are next taken to one of the annealing furnaces and heated to 1,200° F. for a period of thirty-five minutes, and after

FIG. 8. INDENTING 18-PDR. SHRAPNEL SHELL CARTRIDGE CASES ON A 500-TON HYDRAULIC PRESS.

cooling they are taken back to the cartridge shop, and are again drawn. The length of case has been reduced to approximately four inches during the process of indenting.

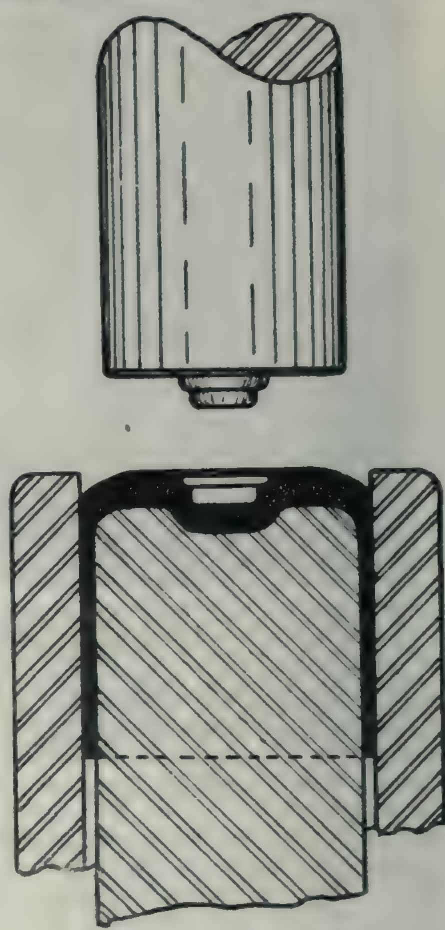


FIG. 7. INDENTING DIES

Third and Fourth Draws.

The cartridge cases are now taken to a Williams & White bulldozer for the third draw, which is the ninth operation. The details of the dies and the punch for this are shown in Fig. 9. The

dies and punch are fitted to the bulldozer in much the same way as in the two previous drawing operations. Mineral oil and tallow are used on the case, and soap and water is placed on the punch and dies. These dies are equipped also with stripping jaws. The cartridge case outside diameter is reduced from 4.083 inches to 3.954 inches, while the length is increased from about four inches to approximately 5.39 inches. The inside diameter has also been decreased from 3.825 inches to 3.752 inches.

The shells are again taken to the blacksmith shop for the tenth operation, which is annealing, being again placed in the furnace and kept for thirty-five minutes at a temperature of 1,200° F. Once more they are brought back to one of the Williams & White bulldozers, on

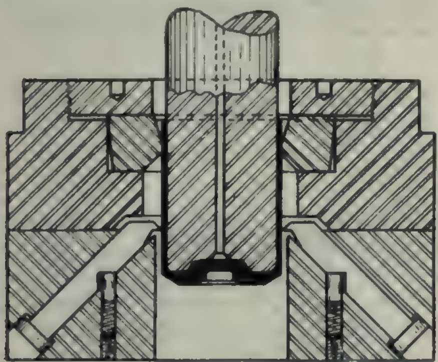


FIG 9. THIRD DRAW

which they undergo the eleventh operation or the fourth draw. The punch and dies, which are shown in Fig. 10, are again covered with soap and water, and the cartridge case is covered with tallow and oil. The outside diameter is decreased from 3.954 inches to 3.845 inches, and the inside diameter is decreased from 3.752 inches to 3.699 inches,

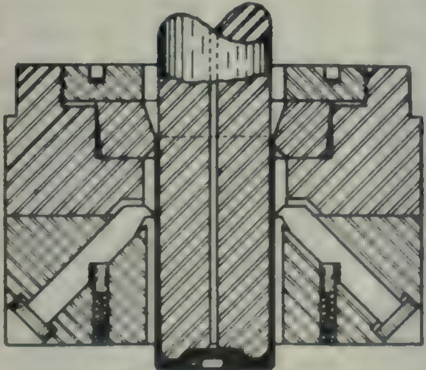


FIG. 10. FOURTH DRAW.

while the length is increased from 5.39 inches to 7.875 inches. The shells then go to the blacksmith shop to be again annealed for thirty minutes at 1200 degs. F. This annealing constitutes the twelfth operation.

Fifth and Sixth Draws.

When the cartridge cases return from the blacksmith shop after having been last annealed, they are ready for the fifth draw or the thirteenth operation. The case has now become so long that the stroke required to accomplish these last two drawing out operations is greater than that of the bulldozers, so planers have been fitted up to do this work. Figs. 11 and 12 show two views of the punch and dies fitted to a Bertram standard type planer. The details of the dies and punch are shown in Fig. 13. The diameter of the cartridge case outside is here reduced from 3.845 inches to 3.789 inches, while the inside diameter is tapered. After the fourth draw, the inside diameter was 3.699 inches for the whole depth, and after the fifth draw the inside diameter is 3.679 inches at the bottom and 3.729 inches at the mouth. The length of the case is also increased from 7.875 inches to 10.75 inches. The case is given a bath of tallow and oil just previous to being put on the punch, while the punch and dies are lubricated with soap and water. The cartridge case now passes on to the fourteenth operation where it is trimmed by little motor driven circular saws to nine inches length. The trimmed ends are collected and pressed in a hydraulic press into bales and are sold to scrap dealers.

The fifteenth operation consists of annealing for thirty minutes in the oil furnaces in the blacksmith shop, at a temperature of 1200 degs. F. The shells are then returned to the cartridge shop

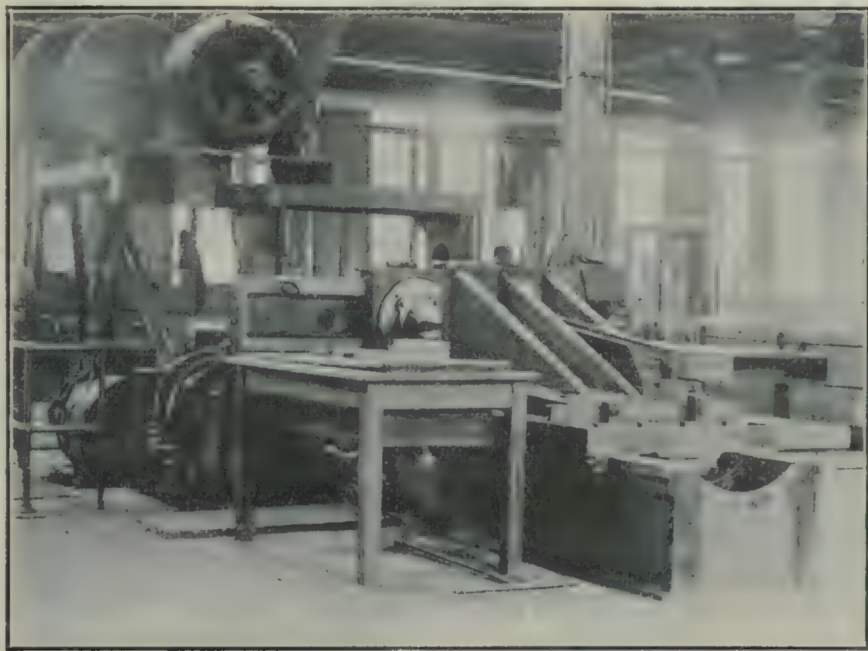


FIG. 11. FIFTH DRAW OF 18-PDR. SHRAPNEL SHELL CARTRIDGE CASES ON A "BERTRAM" PLANER.

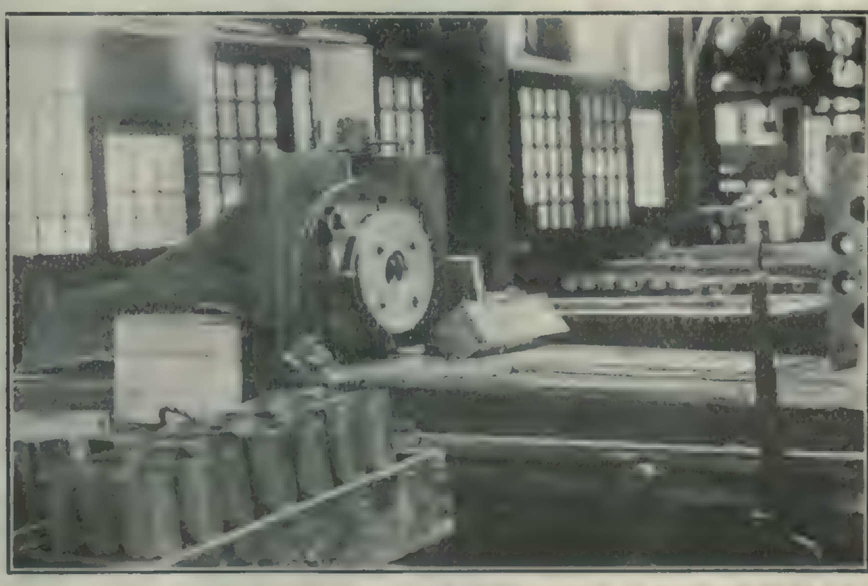


FIG. 12. FIFTH DRAW OF AN 18-PDR. SHRAPNEL SHELL CARTRIDGE CASE ON A "BERTRAM" PLANER.

for the sixth draw which is the sixteenth operation. This draw is also accomplished on Bertram planers with the same lubricants. The outside diameter is now reduced to 3.74 inches, while the inside diameter is shown clearly in Fig. 3. There are two tapers on the inside. The length of the case has been increased

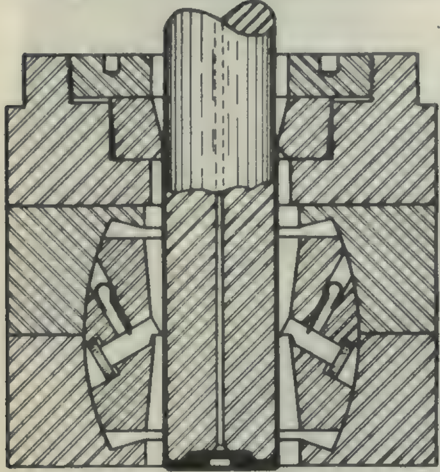


FIG. 13. FIFTH DRAW.

to 13.35 inches in this operation. Details of the punch and dies are shown in Fig. 14.

The seventeenth operation consists of trimming the shell down to 12 inches length, after which it is cleaned in caustic acid and dried in sawdust.

Heading.

The shells are again taken to the blacksmith shop where two 800-ton hydraulic presses are fitted up with dies and punches to do the heading, which is the eighteenth operation. Fig. 15 shows one of the presses. There are four sets of dies on a revolving table, which is pulled around by hand, and locks at every quarter turn. The machine requires three operators. The cartridge cases are first tried over a plug gauge and then into a ring gauge to see if the bodies are within the proper limits to fit the dies. When this test is passed a case is placed in the dies, and with a quarter turn of the table it is placed under the heading punch. The next quarter turn brings it from under the punch, and the third quarter turn brings the dies over a hydraulic piston which ejects the case from the dies. This hydraluic piston thrusts the cartridge case upward until it is grasped by the jaws, which are shown clearly in Fig. 15. The hydraulic piston ram is also clearly seen. No lubricant is used in the heading process. The cartridge cases are now shortened from 12 inches to 11.75 inches, and the shape of the head is seen in Fig. 3. After this the cases are returned to the cartridge shop.

Semi-Anneal and Tapering.

The nineteenth operation is to semi-anneal the cartridge cases in a gas furnace built in the shops. This furnace is clearly seen in Fig. 16. There are eight holes into which the cases are placed mouth first. They are left there for thirty-five seconds only, and then pass to the twentieth operation which is tapering in two stages on a William & White bulldozer. Two sets of dies are placed on this machine, and two operators are required. The first operator receives the cartridge case after it comes from the semi-annealing and places it on the first set of tapering dies. With the return stroke of the bulldozer, the shell is taken out and placed on the second tapering dies, after which it is removed. Neat's foot oil is used as a lubricant in this process. The tapers are clearly shown in Fig. 3, also the accompanying elongations.

Machining.

The twenty-first operation is the machine finishing of the cartridge case and all the operations can be accomplished with one setting on one machine which is a special Bullard turret lathe. The operations required are shown in the

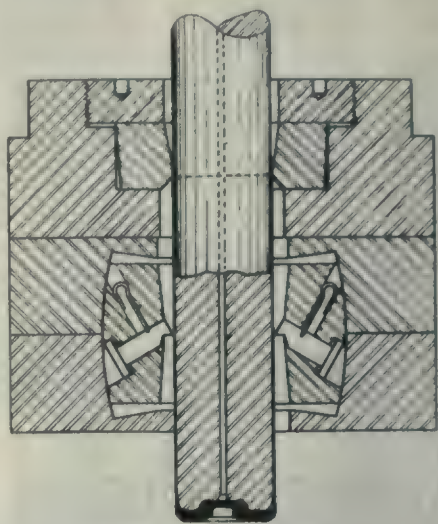


FIG. 14. SIXTH DRAW.

chart on Fig. 3. A turret is mounted on the lathe, and the lathe is equipped with a hollow spindle and a special type of friction chuck. The mouth of the cartridge case extends through the headstock, and a boring tool is mounted on an extension of the lathe bed. The cartridge case is trimmed to 11.60 inches in length and then for a distance of one inch it is bored parallel by this tool. The diameter is then tested by means of a limit plug gauge. The operation trues up the inside of the case for the reception of the shell. The specifications do not allow of any extensive process of boring, as it is thought that perhaps a manufacturer may be tempted to substitute a brass casting for a drawn cartridge. One operator looks after this operation. The second operator, meanwhile, is machining the head.

Fig. -7 gives an idea of the turret tooling on these machines. There is fitted to the cross-slide a tool which faces the end of the cartridge case, and on completing this operation, as the cross-slide is fed further in toward the centre, other tools are brought into the work which turn the various diameters shown in Fig. 3 at the head of the cartridge. All tools approach the work from the near side, and the cartridge case is chucked against a stop and the carriage is locked to the lathe bed. The cross-slide

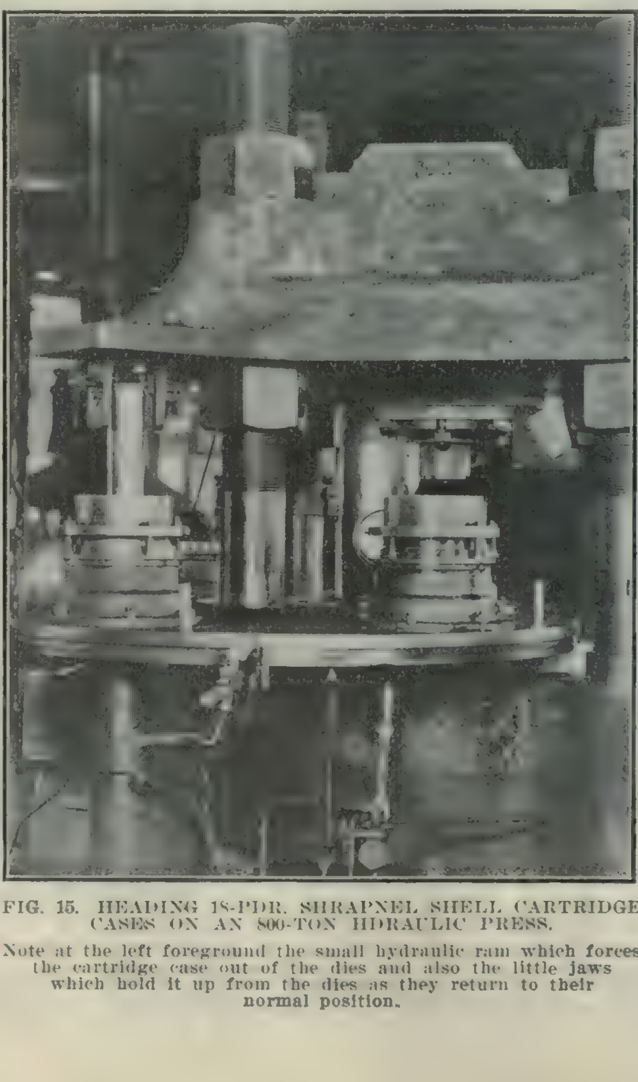


FIG. 15. HEADING 18-PDR. SHRAPNEL SHELL CARTRIDGE CASES ON AN 800-TON HDRAULIC PRESS.

Note at the left foreground the small hydraulic ram which forces the cartridge case out of the dies and also the little jaws which hold it up from the dies as they return to their normal position.

is fed inwards until it is against a stop, hence the machine is almost fool proof. After these operations, the turret tools are fed into the work.

The first tool is a twist drill of several diameters which is fed into the end of the case, and when this tool has been fed in the proper distance a stop indicates same to the operator. The next is a little tool on a boring bar which is placed in the hole just bored. The turret is placed up against a stop and then the tool is fed into the work laterally by means of a cam in the boring bar, which cam is actuated by the little lever shown in Fig. 17. This tool is so ground that it cuts the undercutting groove shown in

HEADING DIES.

Fig. 3, and faces the inside of the hole. The proper depth of the groove is determined by the cam which causes the tool to have cut the groove to the proper depth when the high spot of the cam is pressed against the tool. The next tool is a collapsible tap which taps the hole. Finally a solid reamer is put into the work and this tool completes the series of operations. Soda water is used as a cutting lubricant. As it was not possible on short notice to get the required number of these special Bullard lathes, all the machining is not accomplished on them, several turret lathes having been tooled up to finish the heads of the cartridge cases as well.

Cartridge cases so finished have to be trimmed and have their mouth bored on a separate machine. They are simply chucked in a long jaw collet chuck and gripped firmly enough to resist the tendency to turn with the boring tool and at

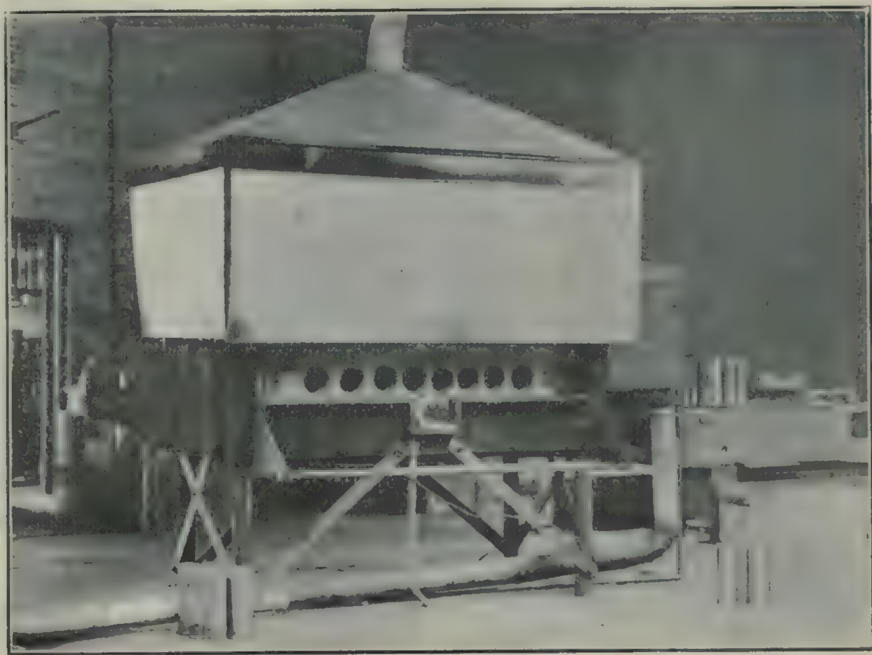


FIG. 16. GAS FURNACE FOR SEMI-ANNEALING 18-PDR. SHRAPNEL SHELL CARTRIDGE CASES PREVIOUS TO TAPERING.

the same time not be sprung out of shape. These lathes are usually hollow spindle machines, and a hand-wheel on the end of a rod is used as a medium to open and close the jaws of the collet chuck.

Fig. 18 shows a Warner & Swasey turret lathe tooled up for finishing the heads of the cartridge cases. As will be seen, the facing tool on the cross slide approaches from the far side while the turning tools are on the near side. The cartridge case is chucked in an internal expanding collet chuck mounted in a cast iron casing which is screwed to the live spindle of the lathe. This cast iron casing is very long, as the whole length of the case has to be gripped, and the outer end is supported in a bearing which is bolted to the ways of the lathe. The shell is chucked against a stop, and, as the facing tool is fed into the work, the cartridge case is faced to length. The carriage is, of course, locked to the lathe ways. Thus, when the cross slide is moved so as to bring the turning tools into the work, these tools enter the work at the proper position. The cross slide comes against a stop when the proper diameters have been turned. The next

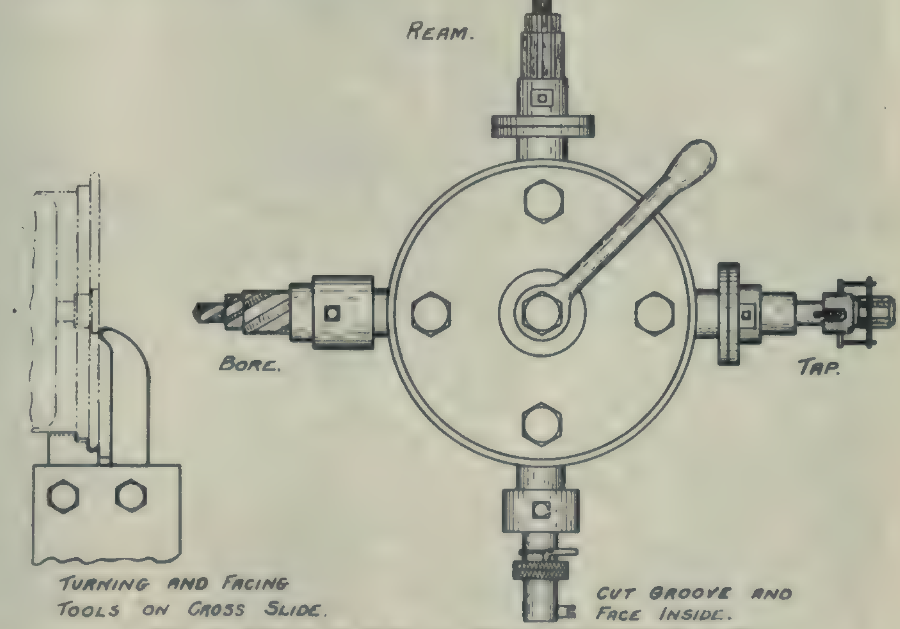


FIG. 17. TOOLS ON SPECIAL "BULLARD" TURRET LATHE.

operations are accomplished by the turret tooling, a diagram of this being shown in Fig. 19.

On the first boring bar there is a twist drill, which bores the rough hole, and the next boring bar carries a flat drill which has several diameters and finishes all the counterbores. Next the inside facing and grooving tool is fed into the work, this being the same tool as was fitted to the Bullard turret lathe. Another boring bar carries the collapsible tap, which is followed by a solid reamer. After this the cartridge case is tested for length with a limit gauge. The thickness of metal at the ends is also tested, together with the inside and outside diameters, the latter by means of plug and ring gauges. The taper is tested with the gauge shown in Fig. 20.

FIG. 18. FINISHING BACK ENDS OF 18-PDR. SHRAPNEL SHELL CARTRIDGE CASES ON A WARNER & SWASEY BRASS TURNING TURRET LATHE.

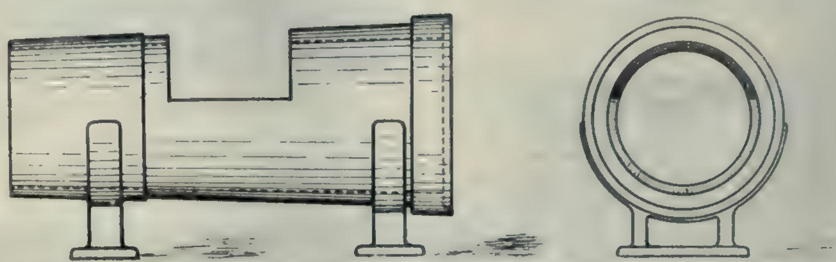


FIG. 20. JIG FOR TESTING TAPER AND OUTSIDE DIAMETER OF BACK ENDS.

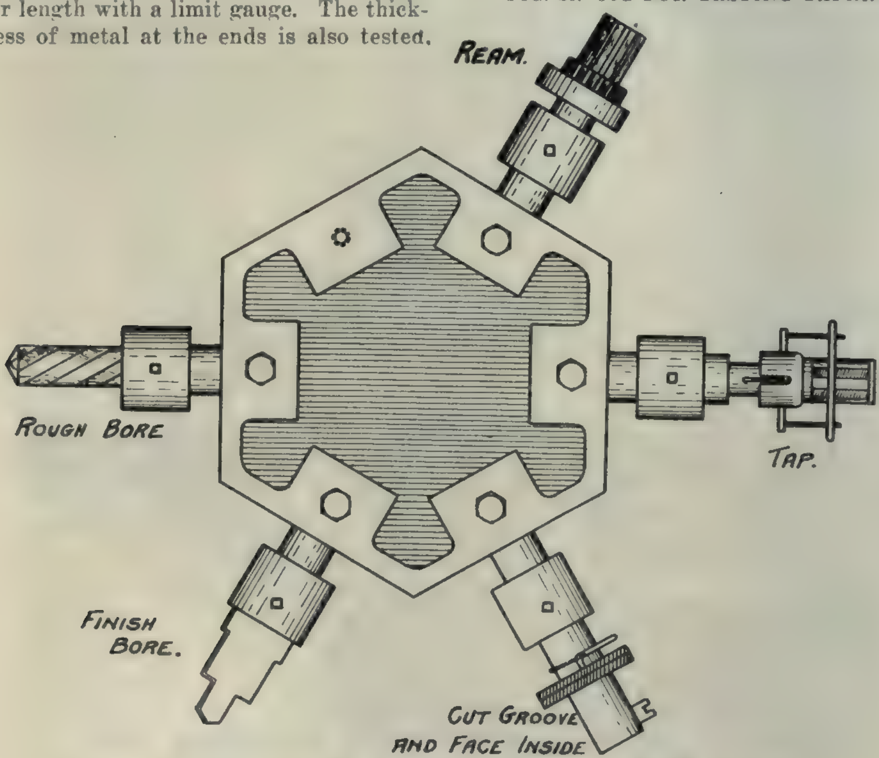


FIG. 19. TOOLS CARRIED ON THE WARNER & SWASEY TURRET.

Finishing on the Bench.

The twenty-second operation is the final testing on the bench. Here the cartridge cases are placed in vises, and a finishing tap is run through the hole in the head. This tap is shown at A, in Fig. 21, which illustrates the gauges and tools used in the bench work. Next, the gauge B is placed in the hole at the head to see if the outer counterbore is of the proper diameter and depth. If it is not right, the hand reamer is used to correct it. Next the tapped hole is tested to ascertain if it is concentric with the counter-bore, tool D being used for this purpose. The low limit size thread is at the same end of the gauge as the flange, while the high limit size thread is at the opposite end. If the tapped hole is not concentric with the counter-bore, the tap is placed in the hole and the reamer E is placed over the tap, and the counterbore is reamed out concentric with the tapped hole. The plug gauge F shows the high and low limit size of the hole in the socket. The low limit must pass through the hole, and the high limit must not.

Stamping, Cleaning and Sand Blasting.

The twenty-third operation is to mark the shell as indicated in Fig. 3, after which the shell is taken to a lathe which has a brass casting screwed on the live spindle. The casting is turned down on the end opposite the head stock. This shank has a thread cut on it to accommodate the tapped hole in the head of the cartridge case, the latter being screwed up against the large solid shoulder of the main casting and held solidly there while it is cleaned up. The twenty-third operation is sand blasting, which prepares the cartridge case for the final operation of black lacquering the inside. This completes the series of operations on the 18-pdr. shrapnel shell cartridge case.

The 4.5 Howitzer Cartridge Case.

The howitzer cartridge case is very much shorter than the shrapnel cartridge case, but the general line of manufacture is much the same. They are annealed in the same furnaces and at the same temperatures as the shrapnel cartridge cases. Fig. 23 shows the complete series of operations, while Fig. 22 shows the Williams & White bulldozer on which all of the four draws are accomplished. The dies and punches are changed to suit the operation. In Fig. 22, the bulldozer is cupping the discs, and the operator is sliding in a disc. The shortness of the case enables all draws to be made on a bulldozer.

The indenting and heading operations are accomplished on hydraulic presses in the boiler shop of the plant. The tapering is done in two stages on one Williams & White bulldozer.

The semi-annealing is accomplished by a very simple gas burning arrangement. Two vertical spindles carry two discs on their ends, and bevel gears from a pulley driven shaft, revolve the two vertical spindles. A circular pipe with holes drilled on its inner side forms the gas burner. Thus the cartridge case is annealed, by being placed on the revolving discs. The machining of the cases, and the tools, fixtures and gauges are similar to those for the 18-pdr. shell case.

General.

At present the shop is not fully equipped and the organization has not been perfected, but the estimated production of the 18-pdr. shrapnel shell cases is 5,000 per day of 24 hours. About 4,000 Howitzer cases, it is expected will shortly be turned out during the same time. The shells are carried about the shop on Chapman Double Ball Bearing Company trucks, in boxes of twenty-five each. Trucks on standard gauge tracks take care of the inter-shop traffic.

The hardness of the brass must be within certain limits or it will not perform its duty when under fire; thus cases have to be sent to the military authorities to undergo a firing test. They have, however, proved to be up to all requirements, and with all the unavoidable disadvantages under which this shop is working, it has most assuredly scored a huge success. The greatest credit is,

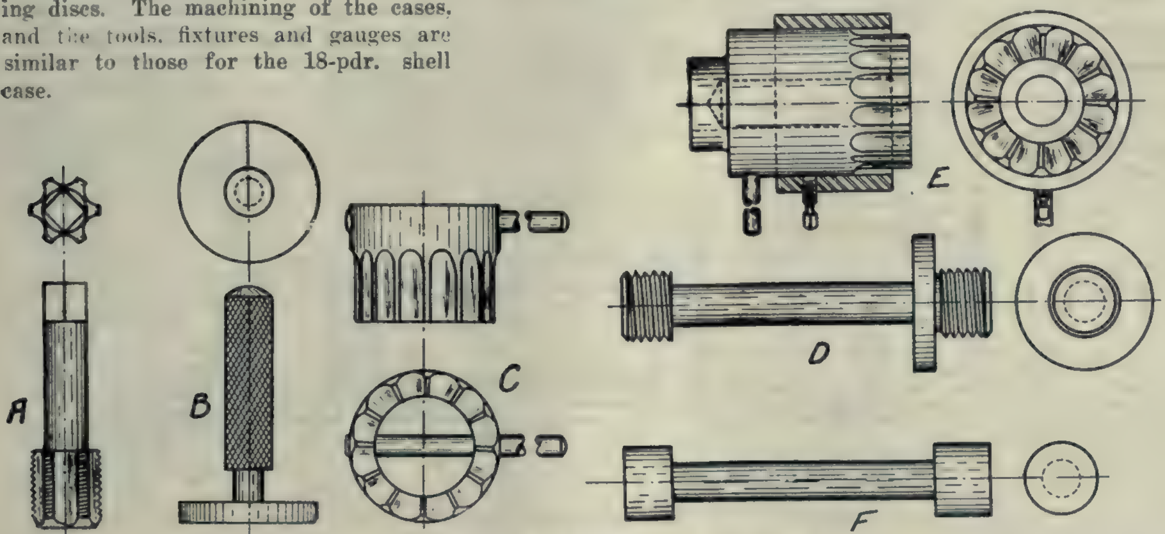


FIG. 21. GROUP OF BENCH TOOLS.

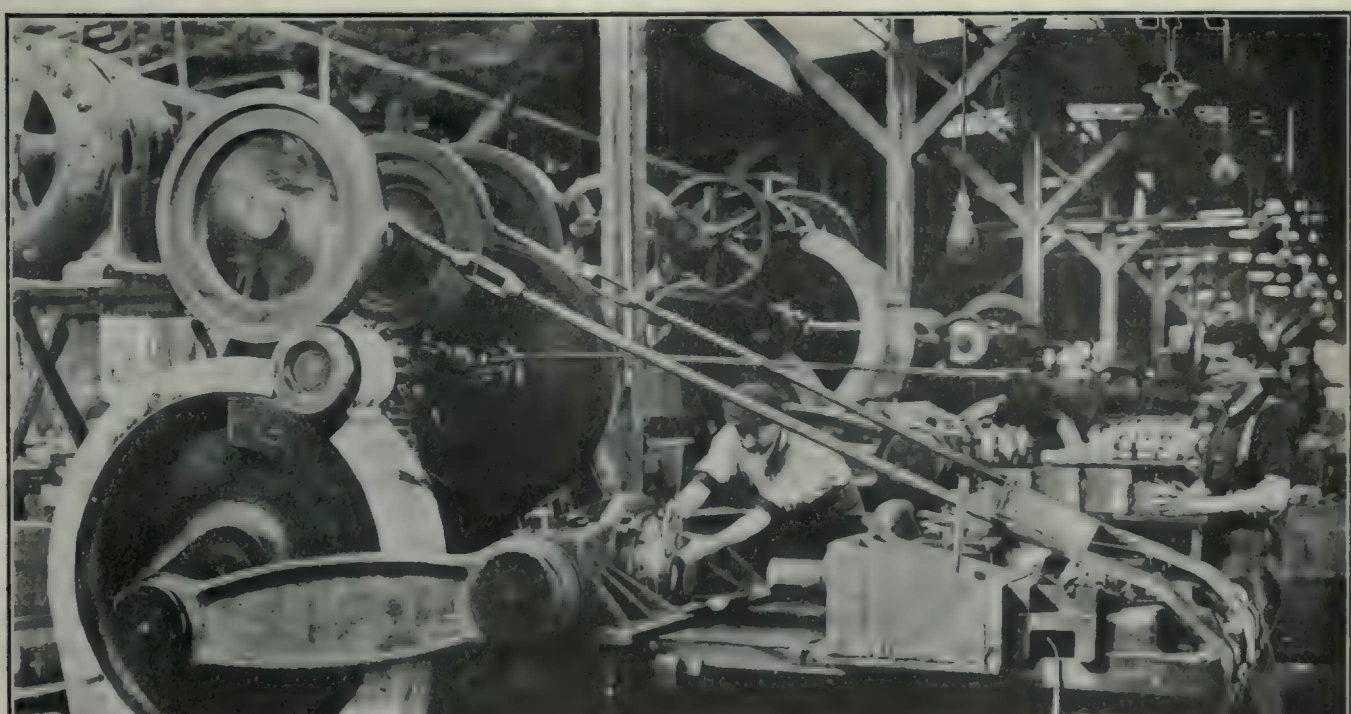
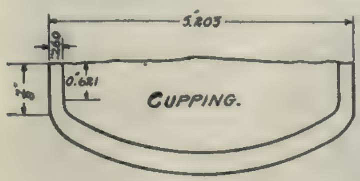


FIG. 22. CUPPING BRASS DISCS IN THE MANUFACTURE OF 4.5 HOWITZER CARTRIDGE CASES ON A "WILLIAMS & WHITE" BULLDOZER.

therefore due to its engineering department for their ingenuity, perseverance and patriotism.

While the layman's appreciation of the time, trouble and worry involved, and of the degree of success achieved, in such an undertaking as the manufacture of shrapnel and howitzer shell cartridge cases by means of equipment altogether foreign to the purpose—not to speak of the necessity of the latter's preservation against radical change in design and arrangement, may be such as to elicit the highest praise and create wonder and amazement, it really falls to the practical mechanical man to give the work being done its true rating. What we have here written serves in some measure to indicate this, but, to grasp the achievement in its fullness, warrants nothing short of one's presence at the scene of operations, and the following out of the processes from start to finish.



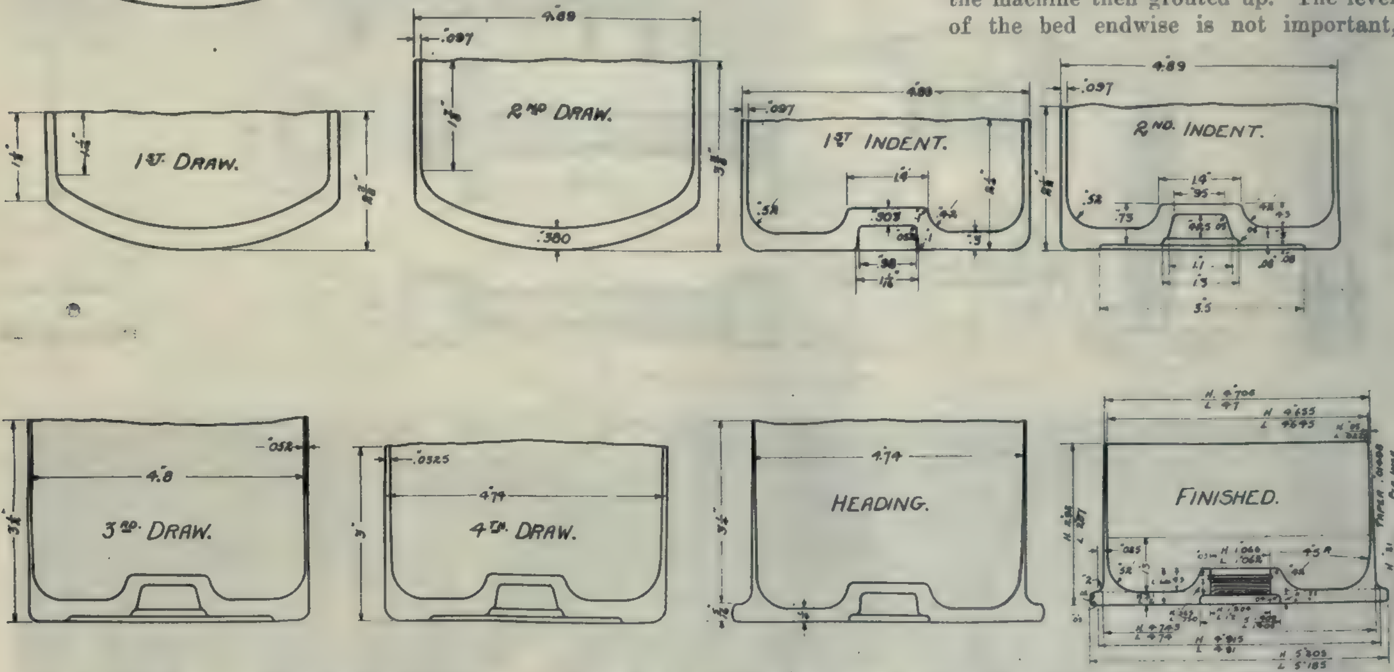


FIG. 23. SERIES OF OPERATIONS THROUGH WHICH THE 4.5 HOWITZER CARTRIDGE CASE PASSES IN THE PROCESS OF MANUFACTURE.

LEVELLING-UP TURRET LATHE BEDS.

IN the current issue of Herbert's "Monthly Review," a short article is given upon the matter of levelling-up turret lathe beds—"a matter of vital importance to the turret lathe user if the machines are to turn out accurate work." What follows is intended to be supplemental and to give added emphasis to a previous article in the same publication, entitled "Hints on the Setting and Levelling-up of Capstan and Turret Lathes."

Setting Level.

Even the stiffest lathe beds, whether for turret lathes or any other kinds of lathes, require to be correctly levelled if the machines are to turn and bore parallel. That this is a matter which frequently does not receive sufficient attention is shown by the following extract from a report by one of our expert operators regarding a number of turret lathes in a customer's workshop:—

"I find that they have simply put these machines down on concrete and made no attempt to level them, and one machine shows considerable crosswind in the bed. They complained of the machine boring taper and asked about moving the heads over. I told them not on any account to touch them until I could return, which would be as soon as possible."

This is typical of a number of experiences we have had of complaints that lathes would not turn or bore parallel or that turret tool holes were not in line with the spindle, and in nearly every case the cause has been the same—namely, crosswind in the bed, due to the fact that the lathe bed had not been levelled. Turret tool holes are bored in position from their own spindles, the greatest care being taken that the beds are perfectly level. Reliable records are kept of the alignments of each lathe so that it is usually possible to quickly locate the cause of complaints when they are made.

Testing and Inspection.

Our system of testing and inspection practically ensures that all lathes are in correct alignment when sent out, and it is never necessary to move a head sideways to correct a supposed error in the parallelism. The correct ways to level a bed is to use a delicate spirit level, which should be placed across the bed close to the headstock and in a similar manner at the right-hand end of the bed. The bed should be levelled by using iron wedges, driven in the first instance, under the inner corners of the cabinets, leaving the outer corners free, the wedges being driven in until the spirit level shows no crosswind. After the bed has been levelled in this way, wedges may be driven lightly under the remaining corners of the cabinets and the machine then grouted up. The level of the bed endwise is not important, the principal thing being to make sure that there is no crosswind.

Shell Making on the Clyde.—An important forward movement to increase the output of shells in Glasgow has just been commenced by the organization of lay labor. At least one clergyman has been working on the day-shift in a certain establishment for several weeks past, and now the members of the Citizen Training Force have come forward to lend their aid also. One company of the latter recently offered the already mentioned plant to keep sixty machines running throughout the night shifts, and, in accepting the offer, the directors suggested that only those engaged in clerical and other similar occupations during the day should be selected for the work of shell-making.

Arithmetic for the Machinist and Workshop Operative

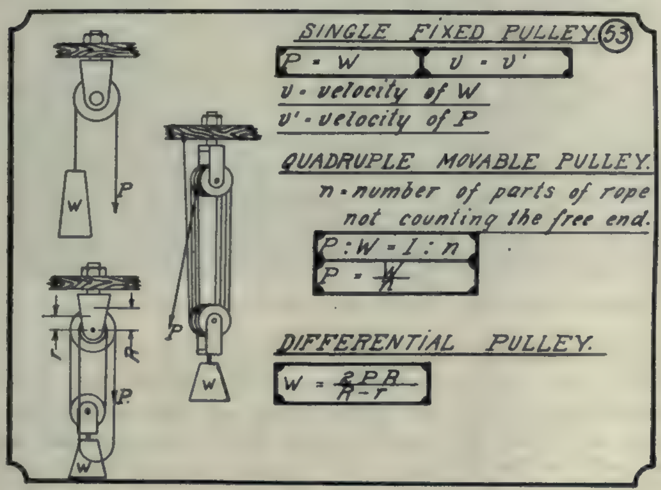
By J. H. Rodgers

It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

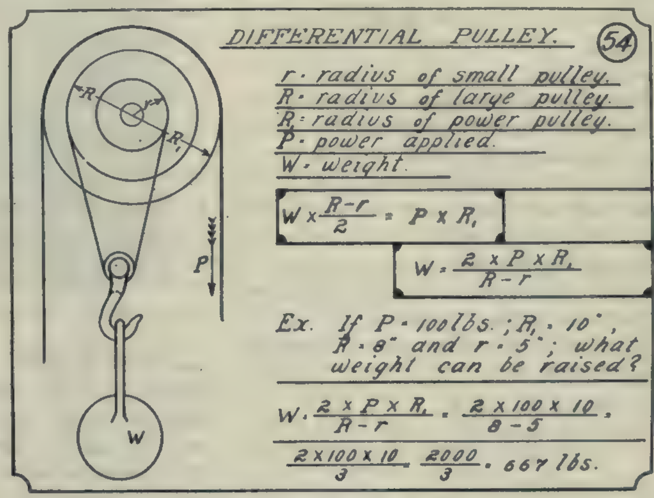
LEVERS.—III.

CHART 53 shows some applications of simple and compound levers, in use on the block and tackle. In the single fixed pulley, the pull on the free end P will equal the weight, as the power arm and weight arm are of equal length. In the multiple movable pulley where one continuous rope is used, the pull P will balance a weight W equal to P multiplied by the number of parts of the rope supporting the load, not counting the free end. In the sketch shown, if a weight of 480 lbs. be supported from the movable pulleys, what would be the pull upon the free end of the rope?

By formula:—$P = \frac{W}{n} = \frac{480}{8} = 60$ lbs.



ARITHMETIC CHART 53.



ARITHMETIC CHART 54.

In the differential pulley shown, the weight is supported by two parts of the endless rope. Now, while the rope is winding up on the larger pulley, it is unwinding from the smaller; therefore, the velocity of W to P will be as one circumference to the other.

$$P \times R \times 2 = W \times (R-r), \text{ or}$$

$$W = \frac{2\,PR}{R-r}$$

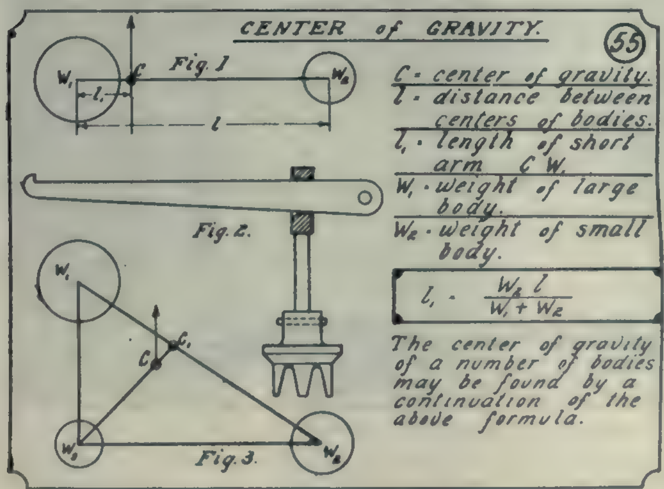
In the differential pulley shown on chart 54, a separate sheave pulley is used for the endless rope, or chain. The rope supporting the weight is similar to that on chart 53, winding on one drum while unwinding from the other.

If the drums supporting the weight are 18 in. and 15 in. in diameter, and the sheave pulley 24 in. in diameter; what weight can be raised by a pull of 100 lbs. on the rope P?

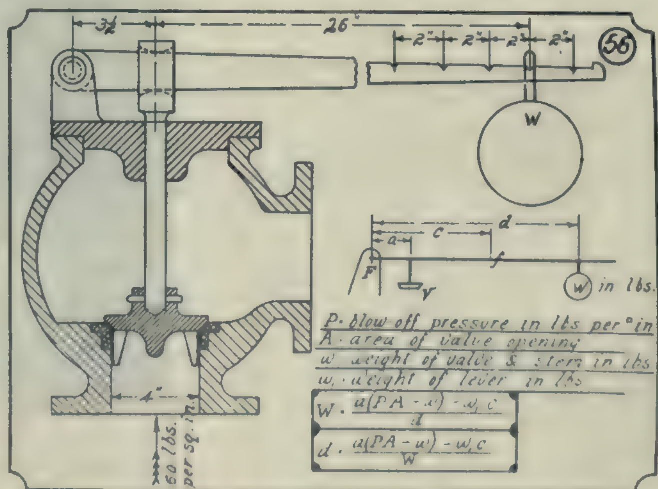
By formula:—

$$W = \frac{2PR_1}{R-r} = \frac{2 \times 100 \times 12}{9-7.5} = 1600 \text{ lbs.}$$

Where one or more forces act upon a lever, it is often necessary to concentrate their combined forces at a certain point for calculation. This point is called the centre of gravity of the various forces or bodies. The centre of gravity of a body is that point at which the body may be balanced if placed in any position.



ARITHMETIC CHART 56.



ARITHMETIC CHART 55.

Two weights W_1 and W_2 are connected by a lever as shown by the sketch Fig. 1 in chart 55; at what point in the lever must the centre be placed to balance the weights?

To be evenly balanced, the moment of

W_1 about (c) (centre of gravity) must equal the moment of W_2 about (c), or the large weight W_1 multiplied by the short arm l_1 must equal the small weight W_2 multiplied by the long arm $l—l_1$.

Where would be the centre of gravity between two weights of 70 and 40 lbs. of 36 in. between centres?

By formula, chart 55

$$l_1 = \frac{W_2 l}{W_1 + W_2} = \frac{40 \times 36}{70 + 40} = \frac{40 \times 36}{110} = \frac{144}{11}$$

13.1 inches from centre of large weight.

Proof:—$W_1 \times l_1 = W_2 \times (l—l_1)$, or

$$\frac{70 \times 13.1}{40 \times 22.9} = \frac{91.7}{91.6}$$ which is approximately correct.

Fig. 3, chart 55 shows the method of finding the centre of gravity of more than two weights or bodies which is a continuation of the above rule.

In chart 56, what must be the weight of the ball W so as the valve will blow off at 60 lbs. per sq. in., the weight of the valve and spindle being 6 lbs., that of the lever 8 lbs.; centre of gravity of lever being 8 inches from the fulcrum?

By formula:—

$$W = \frac{a(PA—w)—w_1 c}{d} =$$

$$\frac{3.5(60 \times 4^2 \times .7854—14)—8 \times 8}{29.5} = 89.01$$

lbs.

Without taking the weight of valve and lever into consideration the weight of ball would be, from formula chart 49:

$$W = \frac{PL}{l} = \frac{754 \times 3.5}{29.5} = 89.4 \text{ lbs.}$$

BOILER EXPLOSION AT SAW MILL, HUNTSVILLE, ONT.

ON Saturday morning, April 17, at 8.10 a.m., a disastrous boiler explosion occurred at the sawmill owned by Field Bros., in Sinclair's Township, twelve miles from Huntsville, Ont., resulting in the complete destruction of the mill and the instant death of George and William Field. An employee, named Prince, who left the mill a few minutes before the explosion, stated that he noticed about 20 pounds gauge pressure when passing the boiler to attend to some outside duties.

The exploded boiler was of the horizontal tubular type, 48 in. x 12 ft., containing 42 3 in. tubes. The shell plates were iron, made up in 4 courses longitudinally and 3 courses circumferentially. The first course was 5-16 in., and the others ¼ in. thick. Longitudinal steams were lap and single riveted with ⅝ in. rivets, pitched 1⅞ in., and circumferential seams had ⅝ in. rivets of 2¼ in. pitch. The heads were ⅜ in. thickness, and the segment above tubes was stayed by 6 ⅞ in. iron stays with crowfoot ends welded. The dome was of cast iron, minimum thickness 15-16 in., with manhole opening 13 in. x 17 in., and was secured to shell by 34 ⅝ in. rivets, the opening cut in shell was not reinforced. The boiler was built by a most reliable boiler manufacturing concern, but was at least 30 years old. The condition was found to be good as far as wasting and corroding was concerned, with the exception of around the blow-off opening, where the original thickness had been reduced to about ⅛ in. It will be seen in the photographs that the old style nozzle at blow-off was forced through the shell.

From information received from a brother of the deceased, who frequently visited the mill, the boiler was laid up last fall and had only been in operation a short time this season, and it was the custom to carry 80 pounds steam pressure. He also stated that the safety valve released then, but, for some unaccountable reason, pressure on the steam gauge could not be raised above about 20 pounds and steam continually leaked through the safety valve. The man in charge of the boiler hung a can on the safety valve lever and filled it full of nuts, bolts, etc., and this extra weight stopped the leakage for a while. When the valve started to leak again, a piece of wood 2 in x 4 in. x 3 ft.. was obtained and securely fixed from the dome to end of safety valve lever, entirely stopping the leakage.

After the explosion, the steam gauge was tested and found to be in good working condition. The stop cock in syphon was, however, completely plugged, rendering the steam gauge inoperative, and the obstruction could not be dislodged with 300 pounds pressure, being the greatest test pressure applied at the time of this writing.

It may be gathered from the condition of the stop cock in syphon pipe that this obstruction was the direct cause of the excessive pressure on boiler, and that the safety valve was not leaking, but performing its duties very nicely, and had given warning that steam had reached the danger point, and that trouble should be looked for elsewhere.

The shell was torn along the top through the centre of dome and down to the longitudinal seam, shearing the rivets as shown. The front head was blown about 300 feet away and landed in a swamp. The rear head was blown in the opposite direction about 250 feet, out into the lake. The shell plates proper took a downward course, and flattened out but did not leave the boiler foundations. The safety valve was found on a hill about 300 feet away. The tubes with broken timber and debris were scattered within a radius of 300 feet. The explosion was the result of inexperience in operation. The boiler was second-hand, at least having been resold several times. The last sale was made shortly before the Steam Boilers Act came into force. Boilers sold or exchanged are now subject to Government inspection, and the inspections are made by inspectors from the Steam Boiler Branch of the Department of Public Works, Ont.

WRECKED SAW-MILL AND PART OF SHELL PLATING.

D. M. Medcalf, Chief of Province of Ontario Boiler Inspection Department is standing at the left of picture.

Coroner's Inquest Finding.

We hereby find that the deceased brothers George and William Henry

Field, came to their deaths in the Township of Sinclair, District of Muskoka on the seventeenth day of April, 1915, as also disfiguring and probably injuring foundations, walls, floors adjoining machinery and goods in process.

FRONT HEAD AND PART OF SHELL WHICH LODGED IN A SWAMP.

the result of an accidental boiler explosion due to over-pressure of steam, and we do not hold any living person or persons responsible for the accident.

LUBRICATION OF TOOTHED WHEELS

ALL toothed wheels require lubrication of some kind upon their working faces. Where the pressure is light, liquid oil may be adopted, but moderately hard grease is required for heavy pressures. In this connection, the primary object is to avoid cutting or galling of the faces of the teeth. Incidentally, the lubricant acts as an elastic cushion and effects a notable reduction in the production of sound. Whatever lubricant is employed, it is important that it should be well applied to as much as possible of the working surface of each individual tooth.

In connection with main spur drives the best method frequently adopted is to apply the grease by means of a brush of suitable type while the engine is turned by the barring gear at a speed sufficiently slow to allow full application to each individual tooth throughout the full width of the working face from side to side of the wheel. For this purpose a large hand paint brush is a very serviceable tool. If the grease is normally too stiff for this method of application it may be softened by a gentle heat. The common method for most wheels is to apply the grease by means of a large brush when the wheels are running. By this means a very large proportion of the grease is at once thrown off and lost:

ELECTRICITY IN ENGINEERING WORKS.

NO feature of industrial development during recent years has attracted more attention than the increase in the use of electrical power in engineering works. In shipyards and iron and steel works, and in many other manufacturing branches whenever any change in the lay-out of the plant or extensions to works have had to be made, the question of operating old or new shops electrically has received serious consideration. The cost of power for current purposes has come down to so low a level in many districts, and the applications of electricity have been so indefinitely extended, that older methods have gradually had to give place to the new aspirant for industrial honors.

The advantage has been a two-fold one. Threatened by the electrical engineer, the adherents of the steam engine have been compelled to search for improvements, and to effect economies of working, which it is safe to say would never have been achieved but for the stress of competition. The result is that the steam engine is a better servant than ever before, and that between a modern steam-driven installation and electrical operation there is often so little to choose that it is frequently a secondary point which decides the issue.

In the end, however, it is all narrowed down to a question of finance, and although the advocates of rival methods are often able to quote statistics showing the advantages of one system of operation over the other, each case has to be decided on its merits and in the light of local conditions.

HEATING AND VENTILATION.

AT a recent meeting of The Society of Engineers (Incorp.), A. H. Barker, Wh.Sc., B.A., B.Sc., read a paper on some future developments in heating and ventilation. The twin sciences of Heating and Ventilation have received but little attention in their scientific aspects. The complexity of the factors that go to make up a given result, and the difficulty of defining in terms of exact science what that result is or should be, are reasons for lack of progress in the science of the subject, and, added to this, one has to take into account the variability of human physiology and psychology as an essential part of the problem.

Physiologists are not even agreed upon as to what is a healthy temperature for human beings to live in. The heating and ventilating engineer aims at producing comfort but is baffled by the fact that a man is comfortable only when he thinks he is. Air which, judged by chemical analysis, is impure may feel fresh and sweet, and vice versa.

The only legitimate function of the engineer is to produce and control specified movements of air and other effects, while it should be the duty of the physiologist and hygienist to specify what are healthy and comfortable conditions. In connection with heating, the expression ''temperature of a room'' is generally understood to mean the reading of a thermometer suspended in the room, but this reading does necessarily indicate the temperature of the surrounding air, or form a reliable guide to the feelings of the occupants of the room. The air temperature, the radiant temperature, the quantity of convected heat and the quantity of radiant heat must all be determined, but first the relation between the thermometer reading, the air temperature and the radiant temperature must be determined. The freshness of air in a building depends on keeping the air temperature relatively low and the radiant temperature high. The chemical composition of the air has, within wide limits, no effect on the human organism, whereas its temperature and humidity are very important.

The paper described experiments made at University College and the apparatus used in connection with them, and discussed briefly some problems which it is sought to solve experimentally.

The Chapman Double Ball Bearing Co., Toronto, have received a contract to supply the American Locomotive Co. with a complete equipment of trucks for handling shells in their plants at Richmond, Va., and Dunkirk, N.Y. The initial order is for over fifty trucks.

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Vol. XIII. JUNE 3, 1915 No. 22

PRINCIPAL CONTENTS.

RECRUITING OUR MECHANICS FOR BRITAIN.

COINCIDENT with the development of shrapnel and high explosive shell manufacture here in Canada, and arising also out of organized concentration in the Motherland to produce an output of these and other equally effective mechanisms, contrivances and engines of war to supply in full measure the most exacting requirements of our soldiers and sailors and their allied comrades, there has arisen a somewhat natural demand for mechanics, or, more specifically, machinists.

Figuratively speaking, the fiery cross is ablaze throughout the length and breadth of the British Isles and this Dominion of ours calling for enlistment to the ammunition supply column, and as a consequence, machinists of all ratings have little difficulty in finding employment, although due to the scope of the offerings they are perhaps relatively unsettled in determining what for them will ultimately have been the wisest course of action.

A machinist and a soldier are synonymous terms these days, each being the complement of the other, and at no time in the world's history has this particular fact been given such forceful expression or has its importance been so vividly portrayed. While it is something for all of us to be alive, so far, in this stirring time, and more so perhaps to be of such an age and sufficiently patriotic as to step out of our chosen routine and take the King's shilling, it is equally something to have acquired a trade and such a trade as will help to furnish the weapons and missiles with which our Empire soldiers and sailors may crush the enemy's bombast, rapine and tyrrany.

Just at the moment a rather interesting development is apparent in Canada relative to the recruiting and enlistment of mechanics for service in the production of munitions of war in the Old Country, and what surprises us in connection therewith is the easy equanimity with which our Government authorities take cognizance of the situation. They appear to be more or less flattered that an Official British Mission of Inquiry concerning armament labor is now in our midst with the avowed intention of securing machinists, including fitters, turners, millers, millwrights, etc.; riveters, drillers, shipwrights, including ship carpenters; boilermakers and boilermakers' helpers, sheet iron workers, coppersmiths, blacksmiths and blacksmiths' helpers, moulders, etc.

Little stir is in evidence (and as for alarm, oh no, because unthinkable), at our Departments of Trade and Commerce and Labor Headquarters, although several scores of our mechanics have already been shipped to Britain and many times more are in process thitherward. Do not the responsible heads of these Departments recognize that the production of shells and other munitions of war is equally important here as in England, and that the work can be equally as well and expeditiously performed. Besides, isn't it well that Canadian industrial enterprise be fostered and encouraged?

Our manufacturers, particularly those engaged in the production of shells, have not had nor are likely to have for some time to come, anything in the nature of a picnic in the planning and prosecution of the work entrusted to them. Difficulties have had to be met and overcome in the rearrangement of their peace-time equipment, in the securing of prompt delivery of additional machine tools, and in maintaining steady, continuous employment for their operators because of, in the first place, a lack of shell steel bars, and secondly because of a lack of shell forgings. Depletion of the labor market by allowing our skilled mechanics to go to Britain will perhaps more than all the foregoing, hit our engineering and metal working plant managements hardest.

We quite realize, that meantime neither our Government nor any Department of it may interfere with the liberty of our mechanics to choose for themselves what they shall do or where they shall go. We have neither got to the stage of martial law nor any other law which may make of us unwilling accessories, but we have reached the point at which a clear declaration should be forthcoming of the absolutely certain, and, as well, almost certain, war business which our craftsmen will not only get the opportunity to produce but will have to do so right here in at least the near future months, or, for that matter, while the war lasts. An idea is all too prevalent among our people, be it inspired or otherwise, that we are simply stopping the gap until the British plants be extended, ultra-equipped and definitely organized, and this feature is, we believe, more than anything else, responsible for the ease with which our mechanics can be constrained to leave our shores.

Representative of Canadian manufacturers, their families and administrative staffs who have heeded the call of Empire for active service on our various overseas contingents.

LIEUT. WM. IAN STRATHEARN HENDRIE.
Hamilton Bridge Works, Hamilton, Ont.

LIEUT.-COL. R. W. PATTERSON.
Winnipeg Paint & Glass Co., Winnipeg, Man.

PRIVATE N. V. CLIFF.
Toronto Salt Works, Toronto, Ont.

LIEUT. G. HUNTLY GORDON,
Ontario Representative, The John Bertram & Sons, Co., Dundas, Ont.

CAPT. F. F. M BROWN,
Sec'y.-Treas. College Press, Ltd., Toronto.

MAJOR KIMMINS.
General Manager, E. D. Smith & Sons, Winona Ont. Killed in Action

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$11 00	$11 00
Copper, crucible	13 00	13 00
Copper, unch-bled, heavy	12 50	12 50
Copper, wire, unch-bled.	12 50	12 50
No. 1 machine compos'n	10 00	10 50
No. 1 compos'n turnings	8 50	8 75
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	10 50	10 50
No. 1 brass turnings	8 00	8 00
Heavy lead	4 25	4 25
Tea lead	3 25	3 25
Scrap zinc	8 00	8 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect May 14, 1915:

	Buttweld Standard Black	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	63	44	....	....
½ in.	68	53	....	....
¾ to 1½ in.	73	58	....	....
2 in.	73	58	69	54
2½ to 4 in.	73	58	72	57
4½, 5, 6 in.	....	....	70	56
7, 8, 10 in.	....	....	67	53
X Strong P. E.				
¼, ⅜ in.	56	44	....	....
½ in.	63	51	....	....
¾ to 1½ in.	67	55	....	....
2, 2½, 3 in.	68	56	....	....
2 in.	....	....	63	52
2½ to 4 in.	....	....	63	55
4½, 5, 6 in.	....	....	66	55
7, 8 in.	....	....	59	47
XX Strong P. E.				
½ to 2 in.	44	34	....	....
2½ to 4 in.	....	....	44	34
Genuine Wrot Iron.				
⅜ in.	57	38	....	....
½ in.	62	47	....	....
¾ to 1½ in.	67	52	....	....
2 in.	67	52	63	48
2½, 3 in.	67	52	66	51
3½, 4 in.	....	....	66	51
4½, 5, 6 in.	....	....	63	49
7, 8 in.	....	....	60	46

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 50	20 75
Castings, copper	20 50	20 50
Tin	40 00	40 00
Spelter	24 00	24 00
Lead	5 85	5 75
Antimony	35 00	40 00
Aluminum	23 50	26 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.82
Linseed oil, boiled, single bbls.	0.85
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.15½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	4 85	4 85
Queen's Head, 28 B.W.G.	5 00	5 00
Fleur-de-Lis, 28 B.W.G.	4 80	4 80
Gorbal's Best, No. 28	5 00	5 00
Viking metal, No. 28	4 50	4 50

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 31, 1915.—Industrial conditions are somewhat improved, speaking generally, the improvement being due directly to the abnormal situation existing. War orders are being distributed much more largely than has been anticipated. The success which Canadian shops have achieved in machining shells is due largely to the ingenuity and determination displayed by the engineers of the various plants in handling the problem. Again, the forging of shell blanks is an industrial development arising out of the war which has also been taken up more or less extensively of late. Although there are few inquiries for steel for construction purposes, the shell business seems to be the channel through which a considerable tonnage is being disposed of. Steel interests are, however, very optimistic regarding the development of foreign trade. The machine tool trade and supply business continue very active, but pig iron is extremely dull and very little improvement is anticipated till the war is over. In the metals, spelter is about the only active specialty at present. There is a good trade in copper, but the prices have not been altered. In other metals not much change is reported. Tin has dropped some, but this was expected, due to the abnormally high price being asked.

The Steel Market.

Although steel consumption throughout the province is considerably below that of a year ago, there is nevertheless quite a nice volume of business pasing at present. It is rumored that there is a possibility of larger shells being manufactured in Canada, and, if so, this will certainly increase the demand for steel.

Building sections are very quiet indeed, the building trade being apparently at a complete standstill.

Machinery bars are in fair demand, and tool steel is selling well, the movement in the latter involving bars and the finished product as well. Many special tools for shell work are being placed on the market by various concerns, and firms like the Armstrong-Whitworth Co., are making a large number of tools to special order for various shops who find out that the pressure of running for twenty-four hours a day leaves but little time to make tools.

There is a scarcity of steel in many British Colonies at the present time. Australia, India and South Africa are requiring considerable tonnage. Shortage of ships prevents the development of this over-seas trade. At the close of the war, however, it is felt that this trade will increase. It is not to be expected that ships will be available before the declaration of peace. It has been very gratifying to see more or less Canadian steel going over the U.S. border of late.

Pig Iron.

The situation keeps unchanged from week to week, and from the outlook at present it will be rather hopeless to expect much alteration for the better for some considerable time to come.

Machine Tools.

The demand for heavy-duty lathes in connection with the manufacture of the larger sizes of shells is now causing a scarcity on the market. Turret lathes have been in greater demand than ever before and deliveries at present are in excess of six months in many instances. Second-hand machines rebuilt and put in first-class running order are selling well, and are giving good service on shell work. Banding presses and nosing presses of various makes are being handled by most of the machinery houses. Hydraulic presses for forging are being installed in a large number of factories, thus adding to the number of forgings being produced. In other lines of tools, business is very quiet indeed.

Metals.

The metal market is more or less active all the time, because of the continued development requirement. The demand for war munitions and the uncertain supply has of course contributed almost entirely to the fluctuations. The past week has not, however, brought as many changes as in some of the previous changes. Copper, after many weeks of activity, has been fairly quiet, although a good volume of business is passing and the prices are firm.

Tin has sagged off five cents per pound, and is now down to forty cents. This is still an abnormally high price, and if shipments continue to arrive from Europe and elsewhere, further reductions may be looked for.

Shortage of spelter has caused the price to soar to twenty-five cents. The British supply came formerly from the Continent, but since the outbreak of war has come largely from the United States; hence the high price.

Lead is a little higher in price, while antimony remains the same. Unusual demands for the latter have caused the price to have rather a tendency to stiffen.

Aluminum is a little easier in price and is now selling at twenty-three and a half cents.

COMING CONVENTIONS.

American Supply and Machinery Manufacturers' Association and National Supply and Machinery Dealers' Association, Hotel Bellevue-Stratford, Philadelphia, Pa. (Joint convention.)—June 3-5.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Railway Supply Manufacturers' Association. Convention and exhibit in conjunction with the Railway Master Mechanics and the Master Car Builders.—June 9-16.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

Associated Advertising Clubs of the World, Chicago.—June 20 to 24.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring Meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

Toronto, Ont., June 1, 1915.—General business conditions are showing some improvement, favorable crop conditions being responsible for a more optimistic feeling, however, the possibility of a protracted war is making everybody cautious in their commitments. The chief feature of interest in the engineering field is the satisfactory progress that is being made in the shell industry; the production is increasing daily and the output will soon reach large proportions. Less trouble is now being experienced through shortage of forgings as more presses are being installed to take care of the increasingly heavy demand. It is not however, certain that this trouble has been entirely eliminated as the number of machine shops engaged in the manufacture of shells is increasing all the time and require a large number of forgings to keep them busy. The Purchasing Commission which was appointed about three weeks ago is now installed in permanent offices at Ottawa and has already transacted a large volume of business. The commission will no doubt be a great benefit to trade and ensure greater efficiency and less wastage than formerly. It is announced that the Government will continue the construction of all Public Works under contract in Canada. This will minimise unemployment and also hasten the completion of works necessary for the development of the country.

Steel Market

The shell industry continues to be the all-absorbing feature in the steel trade and the demand for steel bars and billets for lyddite and shrapnel shells respectively is rapidly developing. In fact, the supply has so far been inadequate but it is to be hoped that this will soon be remedied, otherwise the situation will become serious. Business in other lines is quiet. The building trade is dull and there is little inquiry for merchant bars. Galvanized sheets have advanced 25c per cwt. on account of the high price and scarcity of spelter. It is difficult to gauge the market on account of the general unsettlement, but the tendency is certainly for higher prices unless the spelter situation improves considerably, which at present seems highly improbable.

Pig Iron

The situation remains unchanged and the market featureless. Indications point to a continuance of the present conditions for some time to come. Quotations are unchanged.

Machine Tools.

The active demand for shell making equipments continues and is such that any available tool, new or second hand, is quickly snapped up. The situation as regards deliveries is serious and does not improve. Machine tool manufacturers are in many cases sold up months ahead and firms contemplating making shells are thus faced with the difficulty

of obtaining the necessary tools without delay.

Supplies

The supply business continues very brisk and prices are holding very firm. Brass fittings may advance in price on account of the high cost of copper, spelter and zinc. Rope quotations are very firm and higher prices are within the range of possibility. There is a good demand for belting, cutting compounds, and high grades of tool steel.

Scrap Metals.

Good business is reported in copper and brass scrap with a tendency to higher prices in both cases. The scrap iron and steel markets are quiet. Prices are unchanged and are given in the selected market quotations.

Metals.

The feature this week is the continued rise in spelter due to heavy demand and shortage of supplies. Tin is unchanged but the market has a firmer tendency. The copper and antimony markets are quiet and unchanged but lead is showing greater strength. The large proportion of business passing is for those metals used for munitions, in other respects trade is quiet. The New York metal exchange was closed on Monday, being Decoration Day in the States.

Tin.—After a long dull period with a declining market there are indications of returning activity with higher prices for this metal., The market is quiet but firmer with an upward tendency. Local quotations are unchanged at 40c per pound.

Copper.—The copper situation is unchanged and the market is quiet. Production is on the increase and there are no indications of any falling off in consumption, although there is the possibility of some consumers having fully covered their copper requirements, in which case the demand would not be so heavy. Quotations are firm but unchanged at 21c per pound.

Spelter.—The extraordinary situation continues, the market being very unsettled and supplies of metal almost unobtainable. There is a heavy demand for spelter for all months up to the end of the year but sellers are offering sparingly and no large quantities can be bought. Quotations have advanced 6c and are nominal at 24c per pound.

Lead.—There is more activity in the lead market and the Trust has advanced prices in New York $2 per ton. Local quotations, however, are unchanged at 5¾c per pound.

Antimony. — The Market is a little more active after a period of comparative dullness. The situation is unchanged, the consumption being heavy and quotations nominal. Strength is being shown, but local quotations are unchanged at 40c per pound.

Aluminium.—The market is strong and entirely nominal. The price has advanced 2½c and is quoted locally at 26c per pound.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

St. John, N.B., May 29, 1915.—Business conditions throughout New Brunswick continue to be satisfactory, with prospects at least for some time to come, decidedly encouraging to practically every branch of manufacturing endeavor. The winter-port season has closed in St. John, but it was most successful in its duration, and in the matter of exports there was a heavy volume of trade. War orders are keeping several factories busy, and in some cases there has been revived an extension of space to cope with the augmented trade. Lumbering is another branch in which there is much activity. The cutting and driving season has been satisfactory, and the majority of the big mills throughout the province are now sawing busily.

The big plant of the Chamcook Sardine Co., built not long ago at Chamcook, N.B., a thoroughly modern factory, is soon to be re-opened for operations, the business being carried on by the Lane, Libbey Fisheries Co. of Toronto. The plant has been idle for some time. It is probably the most up-to-date factory of its kind along the Atlantic seaboard, and the understanding is that it will now run in full time. The plant of the Leavitt-Seavey Co. at St. Andrews, a clam cannery, is busy with heavy orders.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

MacKinnon, Holmes & Co. of Sherbrooke, Que., have been given the contract for the steel structural work on the handsome new building of four storeys to be erected in King street, St. John, by Scovil Bros., while the Otis Fensom Co., Toronto, have closed the contract for freight and passenger elevators.

Railroad Extension.

The St. John Railway Co. have extended their lines into suburbs as far as Glen Falls, and a regular service has been established to this growing centre. The company and the city are at present at a deadlock with regard to the matter of pavement and the type of rails to be used in a leading avenue, Princess street, the city insisting on grooved rails instead of the "T" rails proposed by the company, and also asking for a permanent concrete base. No settlement has been arranged as yet, though the matter has been in dispute for nearly a week.

Several thousand dollars' damage is thought to have been done this week in a fire in the Atlantic Sugar Refinery here. The loss has not yet been estimated, but fire and water did considerable injury to the stock and some of the machinery.

DOMINION STEEL CORPORATION NEAR CAPACITY.

THAT the mills of the Dominion Steel Corporation are as active at present as during the busiest periods of its history, is the statement made by J. H. Plummer, the president. Operations are now being carried on at about 90 per cent. of the capacity of the entire works, and there are orders on the books of the company which assure operations to the same extent for at least the next four months. Business on normal Canadian account is, however, practically nil.

At the present time the output of the Dominion Steel Company is about as large as during the most active periods in its history. It should be explained, however, that the business is almost entirely for export, and therefore, not so profitable as domestic trade. The rail mills will presently begin rolling on the 35,000-ton order received for shipment to South Africa, while the steel required for the manufacture of 1,500,000 shells will mean at least partial opera-

tions of the bar mill for at least six months. Inquiries now being received give encouragement that further new business will develop in rails and other products in due course.

CANADIAN PURCHASING COMMISSION IN HARNESS.

A SURVEY of the work of the War Purchasing Commission shows that within the brief time since their appointment by the Government, a mass of work has been accomplished in addition to the preliminary task of organization. The Order-in-Council appointing the Commission was passed on the 8th of May, and the commissioners were notified on the day following. Since then there have been fifteen working days, in which time the commission have selected and equipped their offices, organized their staff, and have awarded contracts involving hundreds of thousands of dollars. These contracts have been awarded by tender, and each has had, it is stated, the closest scrutiny of the commission. They have covered a very wide range of articles of clothing and equipment and of war supplies generally.

The commissioners, in addition to the staff organized by them, are having the co-operation of several branches of the Government service whose duties bear upon the work of equipping and forwarding the troops. The objects for which the commission has been created are to assist the various branches through which the war vote is expended, insofar as the purchasing of supplies, equipment, munitions and materials of war, transportation contracts, etc., are concerned.

The contracts awarded so far, to the lowest tenders in each case, have been for provisions, forage and supplies for all the camps and outposts where troops are training or are on duty, also equipment, surgical appliances, machines, tents, etc., for new hospitals in France, and so on. Large quantities of raw materials for the manufacture of ammunition in the Dominion arsenal, supplies for horse equipment, field telephones, and technical equipment for the railway engineering corps and dental equipment have been purchased and contracts have been let for the transportation of the troops.

The question of boots has also been considered, and an army boot has been turned out in which strength and flexibility are combined. The boot question has not been disposed of finally, but that now being supplied is believed by the commission to be the equal of, if not better, than those worn by the troops of the United Kingdom or their allies. The best advice that could be obtained has been taken in regard to the boots, and further suggestions from any source are being welcomed.

Montreal, Que.—The Thibault Laundry Co. plant has been destroyed by fire.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Orillia, Ont.—The National Hardware Co. has secured a contract for 20,000 4.5 lyddite shells.

Kincardine, Ont.—The Hunter Bridge & Boiler Co. have received an order for 25,000 lyddite shells.

Fredericton, N.B.—The Smith Foundry Co. of this city has received an order for shells from the British Government.

London, Ont. — The Luitweiler Pump Co., 291 Dundas street, is in the market for a plant for the manufacture of pumps.

Niagara Falls, Ont.—The Canadian Niagara Power Co. will shortly commence work on improvements to its plant to cost $3,000,000.

Toronto, Ont.—The St. Clair Foundry Co. has received a permit and will construct an addition to its factory to cost $2,000. Work will be started at once.

Brantford, Ont.—The Ker & Goodwin Co. will build an addition to their machine shop to cost $4,000. The extension will be equipped with machinery for making shells.

Kingston, Ont.—It is reported that a new factory will be in operation shortly for making shells. The plant of the North American Smelting Co. will probably be leased.

Medicine Hat, Alta.—The International Supply Co., is equipping a plant for making shells. The Alberta Foundry and Machine Co., and the Alberta Pump and Brass Works have also received contracts for shells.

Edmonton, Alta. — A contract has been received by the Western Foundry and Machine Co., for the manufacture of 10,000 shells, a similar order having been placed with the Edmonton Iron Works. This will mean an outlay of something in the neighborhood of $100,000.

Toronto, Ont.—The Chapman Double Ball Bearing Co. have applied for a permit at the City Architect's Department to build an addition to their factory with a view to starting the manufacture of high explosives for the British Government. The building will cost $5,500 and will be an extension to the present plant.

Fort William, Ont.—A Government commission will visit this district to examine the iron resources and possibility of development. J. Dix Fraser, manager of the Atikokan Iron Works, is interested.

Municipal

Thorold, Ont.—The Beaver Board Co. factory was damaged by fire recently. The loss is estimated at $17,000.

St. Raymond, Que.—The purchase of fire-fighting apparatus is contemplated by the Council.

London, Ont.—The City Council will purchase a combination chemical and hose wagon.

St. George, Ont.—A by-law has been carried providing for the installation of Hydro-Electric power. Estimated cost, $6,000.

Milverton, Ont.—The installation of a Hydro-Electric lighting system is contemplated.

Bedford, Que.—Extensions and improvements will be made to the water distribution system.

Owen Sound, Ont.—The Town Council contemplate the purchase of a motor truck, estimated to cost about $5,000.

Tavistock, Ont.—A by-law to accept $7,500 for the Carnegie Free Library was carried here on May 27 by 103 majority.

Lynden, Ont.—A by-law will be voted on by the ratepayers to raise $4,500 for the construction of a Hydro-Electric power plant.

Kingston, Ont.—A by-law will be voted on by the ratepayers on June 21 to raise $7,000 to purchase a site for the proposed incinerator.

Thamesville, Ont.—A by-law has been passed providing for the installation of a Hydro-Electric lighting system at an approximate cost of $6,250.

Lindsay, Ont.—The Horn Bros. by-law will be submitted to the ratepayers at an early date. The company are asking the town to guarantee bonds to the extent of $65,000.

Unionville, Ont.—A fire protection system is contemplated for this village. E. A. James, consulting engineer, Toronto, estimates the cost of a complete system (fire and domestic) at $5,000.

Stratford, Ont.—The council has finally passed at the request of the Water Commission a by-law to borrow $50,000 for the purpose of installing a gasoline pumping plant and water tower.

Kingston, Ont.—It is announced that the agreement covering the Campbell power contract has been received from the Hydro Commission, and has been forwarded to the city solicitor for approval and adoption by the city council.

Stratford, Ont.—The ratepayers voted against a proposal to grant the Canadian Bartlett Automobile Co., Toronto, $2,500 and a fixed assessment at $7,500 for ten years in return for establishing a factory here. Lack of public interest rather than organized opposition was responsible for the failure to pass the by-law.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

Tender forms, specifications and indents have been forwarded by D. H. Ross, Trade Commissioner at Melbourne, for equipment required by the Victorian Railways, New South Wales Railways and Western Australian Tender Board. These tender forms have not yet come to hand, but when received, they may be inspected by interested Canadian manufacturers at the Department of Trade and Commerce, Ottawa (refer File No. 1435). Particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:—

Victorian State Railways, Melbourne.

No. 28,766, July 7, 1915. — 1 semi-automatic screw slotting machine and accessories.

N. 28,780, July 14, 1915. — 2 armature banding machines and connecting gear.

No. 28,795, July 14, 1915. — 3 voltmeters as specified.

No. 28, 795, July 14, 1915. — 4 amperemeters as specified.

No. 28,795, July 14, 1915. — 5 wattmeters as specified.

The departure of mails from San Francisco and Vancouver are indicated thus:—From San Francisco —June 8, due Melbourne June 29; from Vancouver—June 9, due Melbourne July 3.

London, Ont.—The council have decided to take no action with regard to the installation of a hydraulic plant at Springbank until a further report has been received. It is estimated that it will cost $10,000 to repair the old machinery and $19,000 for a new plant.

Listowel, Ont.—A large number of representatives from each of the municipalities interested in the proposed Hydro-Electric line from a point near Mitchell to Clifford, met here recently. A resolution was adopted in favor of the proposed scheme.

Mimico, Ont.—At a special meeting of the council, it was practically agreed to accept the terms of New Toronto for the supply of water from the system of that municipality. It is proposed to install a meter in each residence and place of business to register the consumption.

Dorchester, Ont.—Hydro-Electric, enabling and money by-laws were carried almost unanimously by Dorchester ratepayers on May 21. On a by-law to ascertain the opinion of the qualified voters on the question of obtaining power from the Ontario Commission the figures were 70 in favor and only 3 against. On a by-law authorizing expenditure of $4,800 on a distributing plant the vote was 69 for and 4 against. The village is already receiving Niagara power from London.

Trade Gossip

Shell Committee Headquarters.—The headquarters of the Dominion Shell Committee have been transferred from Montreal to Ottawa.

The Canadian Fairbanks-Morse Co. have been awarded a contract for six railway motor cars by the Greater Winnipeg Water District Commission.

The Williams Machinery Co. of Winnipeg, Ltd., have sold a gasoline engine, transmission machinery and machine tools to the Greater Winnipeg Water District Commission.

Workmen's Earnings on the Clyde.—It has been stated that the earnings of the men on the Clyde have increased considerably of late. A wages return from Greenock shows that one riveter has earned as much as $53.50 in a week. His weekly wages for the month ending April 14 were as follows: March 24, $35.25; March 31, $30.50; April 7, $51; April 14, 53.50.

Steel Workers to Australia.—We understand that fifty expert iron and steel workers recently arrived in Sydney, New South Wales, from the United States. They have been engaged to take up position in the recently-erected iron and steel works at Newcastle, and will undertake the instruction of a number of Australians in the industry. A further party has also been arranged for.

Vancouver, B.C.—An order for 1,500,000 feet of lumber has been placed with the Canadian Western Lumber Co., Fraser Mills, by the Dominion Department of Railways and Canals. The British steamer Durley Chine, which sailed from Halifax at the beginning of last month, will load this shipment for Port Nelson, where the lumber will be used in connection with the construction of the Hudson's Bay Railway terminals.

Tenders

Kingston, Ont.—Tenders will be called for the purchase of a 300-kilowatt a. c. generator. For particulars apply to Dr. W. W. Sands, city clerk.

Hull, Que.—Tenders will be received up to June 7 for the supplying of waterwheel, electric generator and centrifugal pumps. Specifications and plans may be obtained at the office of the city engineer, J. P. A. Laforest.

Montreal, Que.—Tenders will be received up to Monday, June 7, 1915, for the construction of west extension grain elevator No. 1, Harbor of Montreal. Conditions upon which copies of the plans and specifications may be obtained will be furnished upon application to F. W. Cowie, chief engineer.

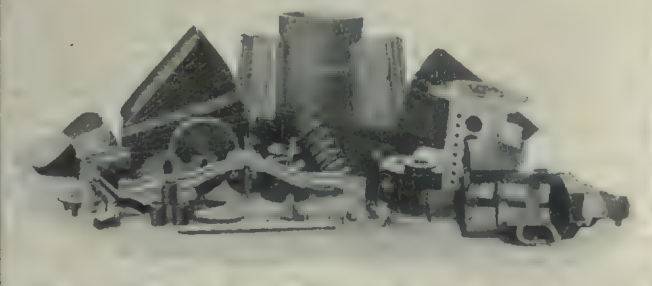
Toronto, Ont.—Tenders for all trades for roof, etc., required on new boiler house, main pumping station, foot of John Street, will be received up to Tuesday, June 8, 1915. Specifications and forms of tender may be obtained at the office of the City Architect, City Hall.

Winnipeg, Man.—Tenders addressed to the Chairman, Board of Control, will be received up to Saturday, June 5, 1915, for the manufacture, delivery and erection in the generating station at Point du Bois of one 150 k.w. motor-generator exciter set. Instructions to bidders, specifications and form of tender may be obtained at the office of the City Light and Power Department, 54 King Street, Winnipeg.

Burlington, Ont.—Tenders will be received until Tuesday, June 15, 1915, for the following works:—Contract "A"—Labor laying sanitary and storm sewers sub-divided into eight contracts; "P"—Constructing sewage pumping station; "S"—Furnishing sewer pipes; "X"—Constructing sewage disposal works. Plans and specifications may be seen at the office of Chipman & Power, engineers, Mail Building, Toronto, or at

A FEW ARTICLES

Including Steel, Aluminum, Cast Iron, Malleable Iron, Brass, Copper and Sheet Steel that have been



WELDED BY OUR OXY-ACETYLENE PROCESS

With our welding outfits on the job, you will increase the productiveness of your plant and save many an expensive machine part from the scrap heap.

The Approximate Cost of Oxy-Acetylene Welding:
Oxygen at 3 cents per cubic foot—
Acetylene at 1 cent per cubic foot—
nothing as compared with service rendered.
LET US PUT FULL DETAILS BEFORE YOU NOW. Send in your request for same now—**you've nothing to lose and much to gain.**

The Metals Welding Co.

CLEVELAND, OHIO

Keen Kutter Cutting Compound

a most efficient lubricant for use on lathes, for drilling and cutting, protects the dyes, very cooling, is easily mixed, and the best article on the market for the work.

Shell Tempering Oil

is an oil prepared by us to meet the special requirements for **tempering shells.** We also manufacture Lard and other cutting oils required for special work, and will be pleased to quote on request.
ALL our goods are MADE IN CANADA and guaranteed.
Write us to-day if you are in the market.

The Commercial Oil Company Limited

Hamilton, Ontario

MADE IN CANADA

HOSKINS

TRADE MARK REGISTERED

ELECTRIC BAKING OVENS

For baking the varnish in high explosive shells.
Accurate heat control; no injurious gases; perfectly even and unvarying temperature.
Shells placed on trucks, making loading of furnace simple.

Write for blue prints and particulars.

No. 51

Maximum tool efficiency. Flames do not touch the tools.

For high-speed or carbon steel.

Chamber dimensions 7" x 9" x 12".

$60.00 f.o.b. Walkerville.

Lead Pots

Special extra heavy construction for heating 4.5 high explosive shells for nosing.

Stewart Gas and Oil Furnaces

CANADIAN HOSKINS LIMITED

Electric Gas and Oil Furnaces and Pyrometers

WALKERVILLE, ONT.

the office of J. C. Allen, town clerk, Burlington.

Toronto, Ont.—The Advisory Industrial Committee of the Board of Education will receive tenders on or before Tuesday, June 8, 1915, for furniture, bicycle racks, metal numbers and letters, picture framing, paper trimmers, blue print ironer, cupola, steam engine, plumbers' and steamfitters' tools, etc., power sewing machines, bricklayers' and plasterers' tools, dust collector system, physical apparatus, projection apparatus, tool grinders, gas and electric furnaces, ladders. Plans and specifications may be seen at the Principal's Office, Dr. A. C. McKay, Technical School, 149 College street.

Personal

E. V. Buchanan, who has been electrical engineer at London, Ont., for some time, has been appointed general manager of the commission to succeed Mr. Glaubitz, who has resigned.

Lieut. James Gordon Ross, of the 13th Battalion, whose name recently appeared in the casualty list as wounded, was consulting engineer of the Milton-Hersey Co., Montreal, and was a lieutenant in the 5th Royal Highlanders.

Pierre Martin, one of the inventors of the Siemens-Martin process of steel-making, commonly known as the open hearth method, died at Paris on May 23. He was a member of the firm of Martin Bros. of Sireuil, France.

Alexander Baird, who, for many years, was superintendent with Cowan & Co., Galt, Ont., has accepted a position with the Canada Machinery Corporation, Ltd., as superintendent of their Hespeler factory, which will resume operations at an early date.

R. S. Richardson, for some time assistant superintendent of the Halifax and St. John district of the I. C. R., with headquarters at Moncton, has been appointed superintendent of the Fort William-Winnipeg division of the N. T. R., with headquarters at Winnipeg, Man.

Catalogues

High Speed Drills.—A very attractive catalogue has been issued by Baker Bros., Toledo, Ohio, dealing with the heavy pattern high-speed drills which they make. Each type is described in detail, covering the principal features and accompanied by a specification giving all the leading dimensions and other data. The half-tones are excellent reproductions and show in a clear manner the general design and location of parts.

CLASSIFIED ADVERTISEMENTS

¶ Those who wish to sell or buy a business, obtain competent help, connect with satisfactory positions, or secure aid in starting new enterprises should not fail to use the Want Ad. Page of "CANADIAN MACHINERY."

¶ If you want to sell or buy a second-hand lathe, planer or any other shop equipment, let "CANADIAN MACHINERY" pick out a seller or buyer for you. How about that second-hand engine or boiler which you would like to dispose of?

Rates (payable in advance):—2c per word first insertion, 1c per word subsequent insertion, 5c additional each insertion when Box Number is required. Each figure counts as one word.

FOR SALE

THE PROPRIETOR OF LETTERS PATENT No. 126215, relating to "Pump device" desires to dispose of the patent or to grant License to Interested Parties at reasonable terms with a view to the adequate working of the Patent in Canada.
Inquiries to be addressed to the patentees, Aktiebolaget Ingeniorsfirma Fritz Egnell, Stockholm, Sweden.

Smooth-On Iron Cement No. 7 is the subject of pamphlet No. 4 being distributed by the Smooth-on Mfg. Co., Jersey City, N.J. This material is used in combination with Portland cement for waterproofing brick and concrete construction. Views are included showing swimming pools waterproofed with this mixture. Copies of this pamphlet will be mailed on request.

The Jones Underfeed Stoker is described in a new bulletin issued by the Jones Underfeed Stoker Co., Ltd., Toronto. The bulletin contains a detailed description of the stoker with special reference to the principal features embodied in the construction and its application to various types of furnace. The smokeless feature of this stoker is dealt with, and the illustrations show a number of installations and sectional views of furnaces.

Electric Drills.—Bulletin No. 103 fully describes twenty different styles and sizes of the "Hisey" improved portable electric hand and breast drills for operating on either direct or alternating current. The universal motor type drills also described are designed for operating on either direct or alternating current of the same voltage. The catalogue is fully illustrated and tables give the essential particulars for each type. Copies may be obtained from the Hisey-Wolf Machine Co., Cincinnati, Ohio.

Wagon and Truck Loaders.—The many uses to which the Jeffrey wagon and truck loaders are adapted are described in bulletins No. 5, 165 and 166 recently issued by the Jeffrey Manufacturing Co., Columbus, Ohio. These bulletins describe in detail the standard types of loaders for handling coal, coke, crushed stone, sand, and other loose materials. The various types are illustrated and specifications are included for each with prices and weights, etc. Copies will be mailed to interested readers upon request.

The June issue of Graphite, the house organ of the Joseph Dixon Crucible Co., contains upon its cover a splendid reproduction of "The Pour," a bronze statue at the offices of the Damascas Bronze Co., Pittsburgh, Pa. "The Pour" was modeled by H. Mueller and imported from France. Though efforts have been made to trace its origin, no further knowledge of it has been obtained. Graphite contains its usual miscellany of good things to read.

HINTS TO BUYERS

GEARS

HAMILTON

GEAR & MACHINE CO.

CUT GEARS

Cor. Concord & Van Horne

TORONTO

Poor gears don't pay dividends.
No, nor your maintenance bills either.

Gardner Disc Grinder

Gardner Disc Grinders are made in all sizes, types and combinations. We can successfully meet any disc grinding problem in existence. Largest builders of Disc Grinding machinery in the world.

Gardner Machine Co.
The Disc Grinding Authorities
BELOIT, WIS.

Canadian Agents: A. R. Williams Machinery Co.

SHAFTING

Cold Drawn, Turned and Polished Steel, Rounds, Squares, Hexagons and Flats, Steel Piston Rods, Pump Rods.

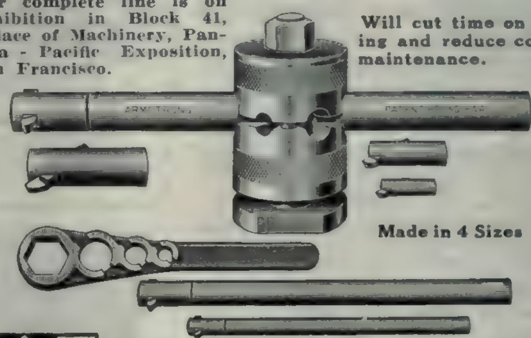
Special facilities for Keyseating up to 6 in. diameter.

THE
Canadian Drawn Steel Co.
Limited
Hamilton Canada

THE ARMSTRONG 3-BAR BORING TOOL

Our complete line is on exhibition in Block 41, Palace of Machinery, Panama - Pacific Exposition, San Francisco.

Will cut time on your boring and reduce cost of tool maintenance.



A Modern High Speed Tool

Made in 4 Sizes

Catalog for the Asking

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
306 N. Francisco Avenue, Chicago, U.S.A.

Allen Safety Set Screws

Any length, point or thread. We make a specialty of short lengths.

ALLEN SOCKET CAP SCREWS
are very neat in appearance and exceedingly strong.

Send for circular No. 3 and free sample screws.

The ALLEN MFG. CO.
Hartford, Conn.
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IT IS IMPORTANT!

If you have something to dispose of in goods or service that as many buyers as possible get to know you and your product. This can be accomplished through

Canadian Machinery
143 University Avenue, Toronto

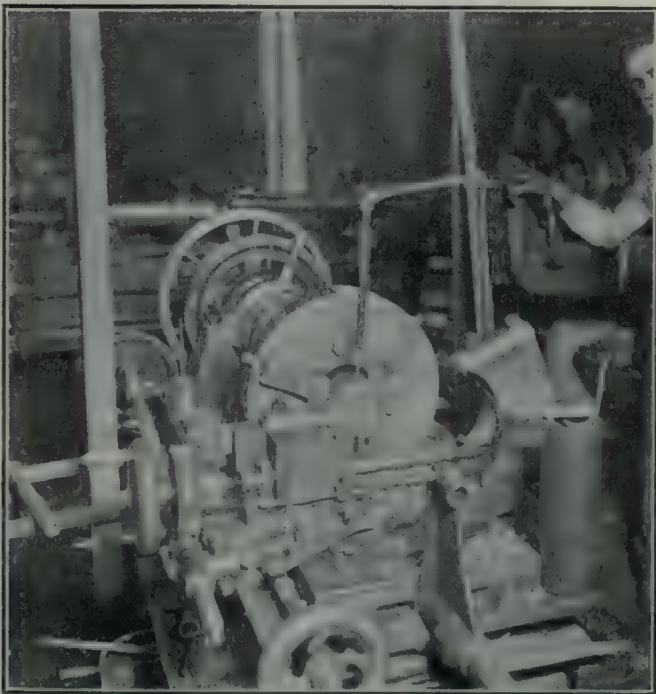
Shrapnel Shell Manufacture

Shell Department of a Power Specialty Manufacturing Plant

Staff Article

Resourcefulness in gripping and mastering the details of shrapnel shell manufacture has not, as will have been noticed from our leading articles in this and recent issues, been confined to any particular section of Canadian mechanical engineering enterprise. The plant here featured, although not a leader in point of size, earns that distinction in its output.

THE plant described in this article was well equipped for conversion to shell making, yet considerable ingenuity had to be exercised in adapting the existing machines, by fitting the necessary tooling fixtures, to suit the new class of work. Although practically no new tools were purchased except duplicates of existing machines in one or two cases, the results have been eminently satisfactory, and further emphasize the progressive spirit of Canadian manufacturers in the engineering field. At this plant shrapnel shells only are at present being made, but the manufacture of high explosive shells is contemplated. The operations hereafter described begin at the machining of the forgings which are received in carload lots.



TRIMMING OPEN END AND SQUARING BASE OF SHELL ON A HURLBUT-ROGERS CUTTING-OFF MACHINE.

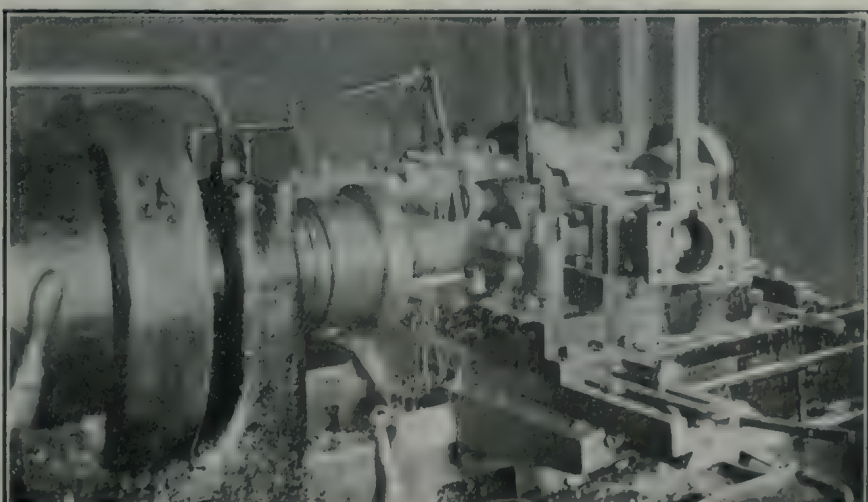
Cutting Off to Length.

The first operation consists of cutting off the forgings at the open end in a Hurlbut-Rogers cutting-off machine. The correct length is regulated by means of a bar gauge carried in a bracket fixed to the end of the machine. The forging is held in a universal chuck, and the bar inserted to a distance regulated by a collar, the bracket acting as a stop, the forging being pulled forward until end of bar touches inside of base. The chuck is then tightened up, the bar removed, and a tool at the side cuts the necessary amount of metal off the end of forging.

The same type of machine is used for truing up the base of shell forging. The latter is placed in the chuck open end first, until the bottom of the inside of shell touches the stop inside the hollow head-stock spindle. This stop acts as a gauge and insures the forging being cut to the desired length.

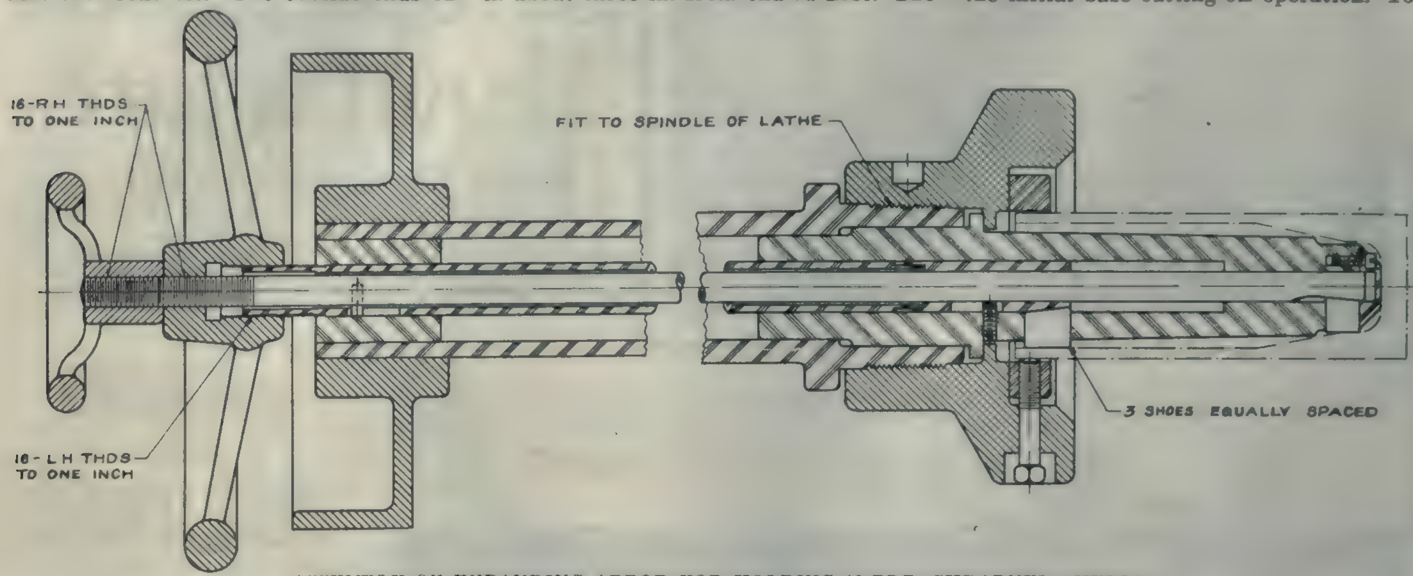
Rough Turning Outside Body.

The next step consists of rough turning outside of body, rough turning groove, and finishing base. This operation is performed on a Potter & Johnston automatic, and the style of tooling fixtures can be seen in the illustration. The forging is held firmly in position by means of an expanding arbor, which was designed by the Chapman Double Ball Bearing Co. specially for this class of work. The arbor has three shoes at the front and three at the back, all tapered, which grip the forging inside at the base end and inside at the nose respectively. Inside the hollow mandrel and extending the full length of the headstock is a sleeve



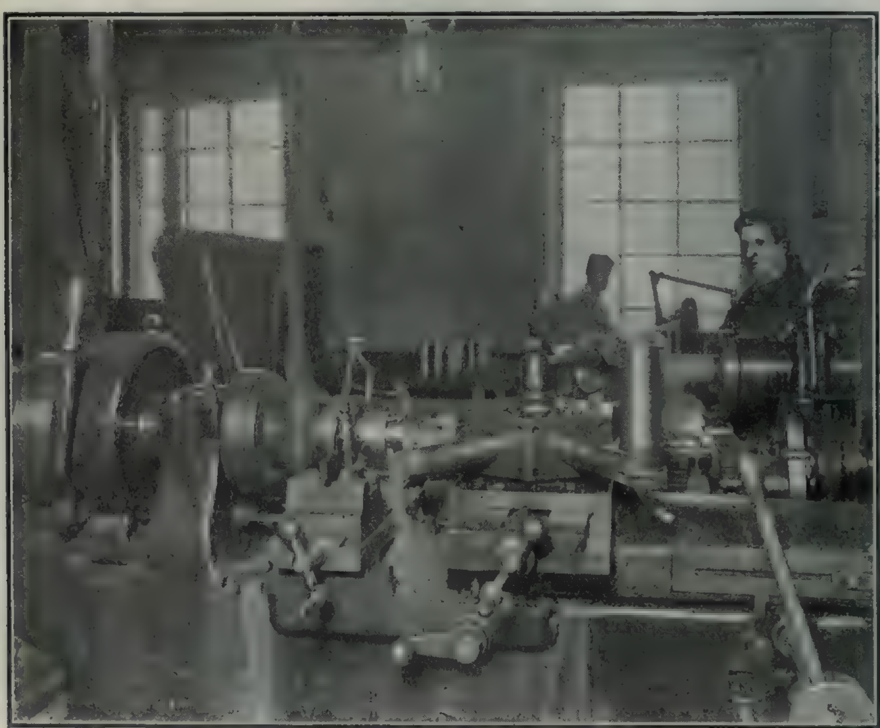
ROUGH TURNING BODY, FINISHING BASE AND FIRST GROOVE CUTTING.

which operates the rear set of shoes, and inside the sleeve is a shaft which operates the front set. The outside ends of



ASSEMBLY OF EXPANDING ARBOR FOR HOLDING 18-PDR. SHRAPNEL SHELLS.

shaft and sleeve are threaded right-hand and left-hand respectively, a hand-wheel threaded to suit operates both and thus tightens or releases the shoes in the arbor. The, chuck has a floating ring which is tightened on nose of shell and drives same.

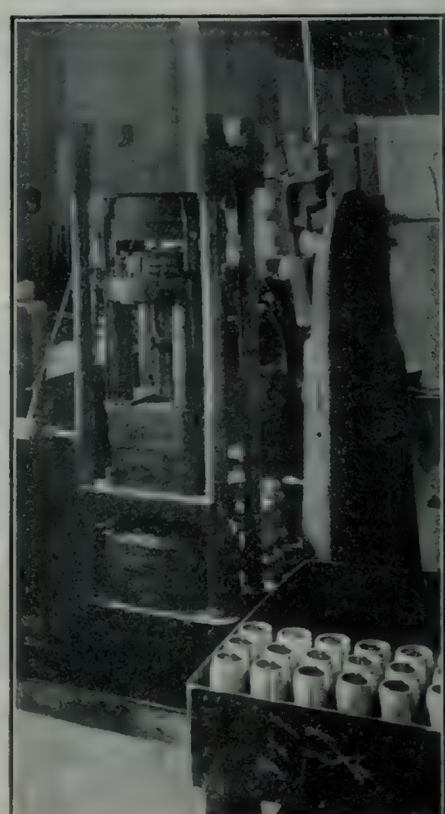


BORING POWDER POCKET AND DIAPHRAGM SEAT, ALSO ROUGH TURNING OUTSIDE OF NOSE.

The forging is in the first place machined on the body near the base for about 1 in. length. This is done to permit the rollers on the next tool engaging with the forging in advance of cutting tool. It is also a means of ascertaining that the forgings will clean up all round. A cutter in first turret face performs this operation. The next tooling fixture rough turns the body of forging to within about three in. from end of nose. The tool is shown in operation in the illustration, and from which it will be observed that there are two steadying rollers attached to same fixture as the cutting tool. The third turret face holds a tool for finishing the base and body of shell as far as the groove. The fourth face holds a cup-shaped centre which engages with the base of forging and holds it steady while the tool in the holder on cross-slide cuts the groove. When turning the groove, sufficient metal is left to allow for the wave being finished later. At the end of this operation it sometimes happens that the base requires further machining to make it absolutely true, in other words, to correct the initial base cutting-off operation. To clean up the base, the forging is taken to a Jones & Lamson turret lathe equipped with a special cutter for this purpose.

Boring Powder Pocket and Diaphragm.

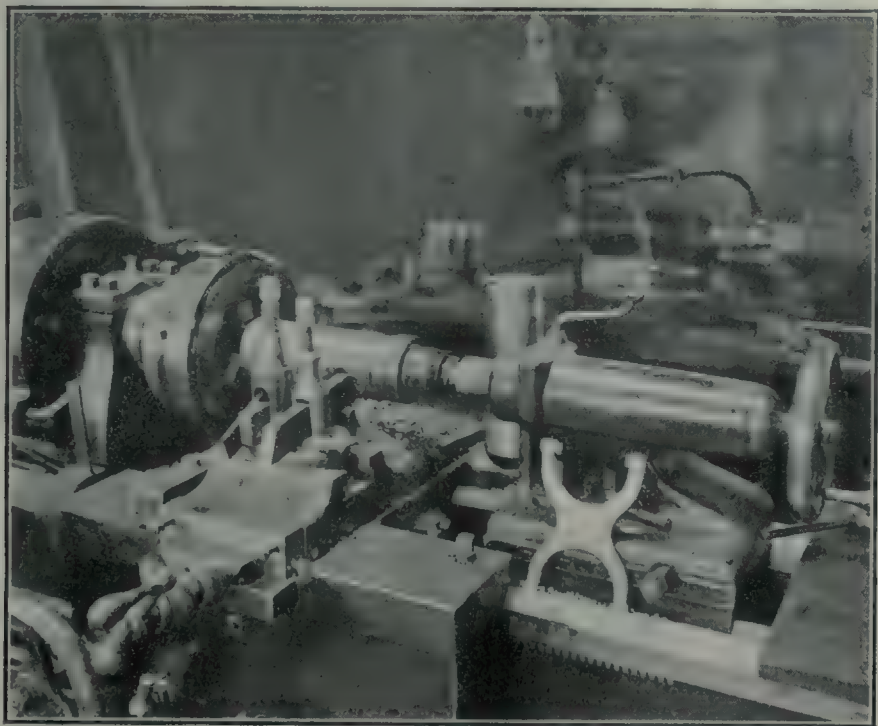
The fourth operation consists of boring the powder pocket and diaphragm seat, rough turning outside of nose taper and, if necessary, facing end of the forging to the correct length. This operation is performed on a Potter & Johnston automatic machine. A Davis turret lathe is also used for this operation. The



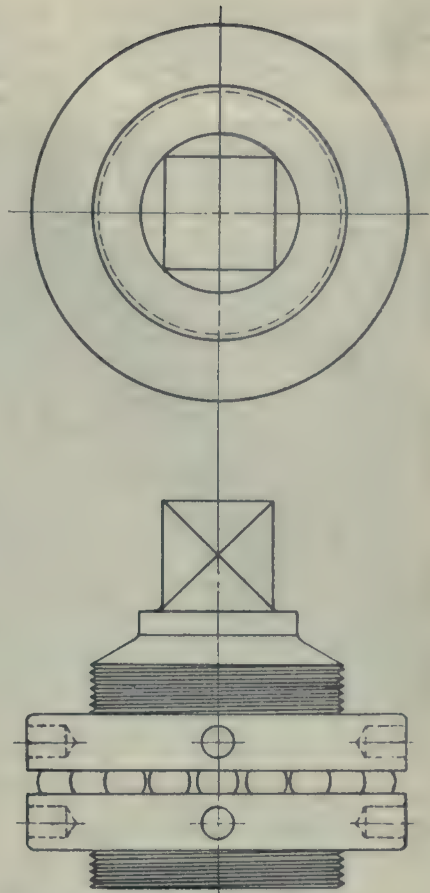
BANDING PRESS.

tooling is the same in each case, but, of course, the operation of the turret is characteristic of the respective types of machine. The forging is held in a special chuck, the gripping dogs being inside, and at the front is a ring for keeping the forging central.

The first turret face holds a boring bar with two small cutters for rough turning the diaphragm and powder pocket sides. At the same time, the back half of nose is rough turned by a tool held in a holder on the cross-slide at the back. The slide is at an angle to give the desired taper and a fixture on the turret forces the tool along at the same speed as the boring bar. The second turret face holds a boring bar fitted for finishing the diaphragm sides and seat. On the turret face at the side is a tool which rough turns the front half or nose taper. The third turret face holds a tool fitted with a radius cutter for finishing the powder pocket. The forging is now gauged for correct size of powder pocket and diaphragm.



GROOVING AND WAVING OPERATION.

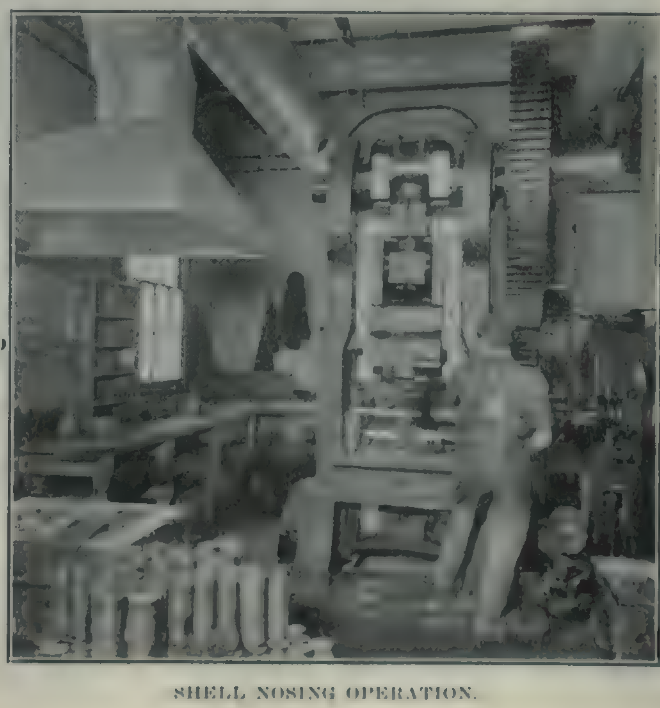


SOCKET NUT FOR 18-PDR. SHRAPNEL SHELLS.

Waving and Undercutting Groove.

At the next operation, the waving and under-cutting of the groove is done to take the copper driving band. A Reed engine lathe is utilized for this work, equipped with special attachment. It will be observed from the illustration that the tool-holders are side by side and that the forging is held in a universal chuck fitted with a cam to impart the necessary oscillating motion to the

TESTING FOR HARDNESS WITH "SHORE" SCLEROSCOPE.



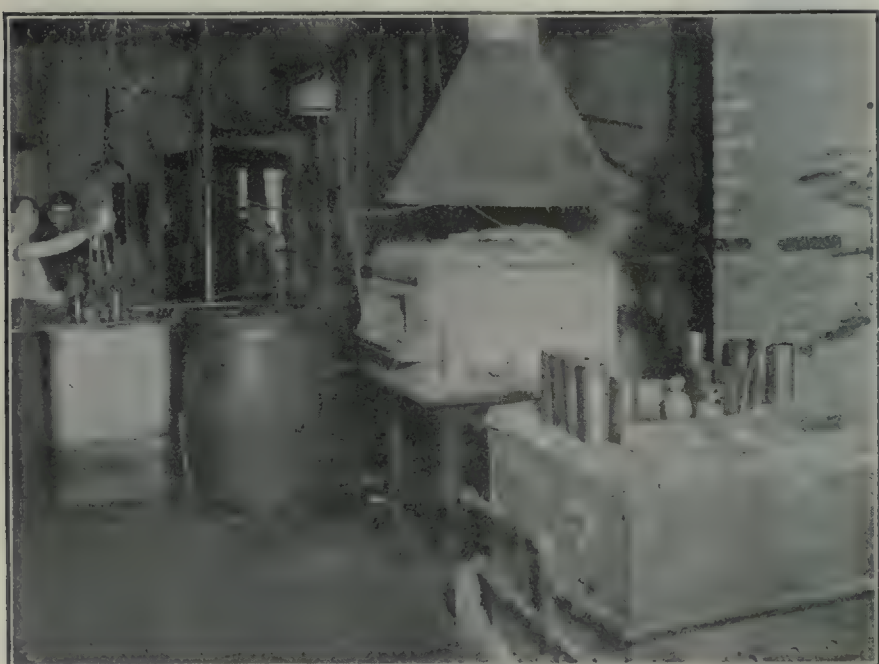
SHELL NOSING OPERATION.

saddle during the waving process. When setting the forging in the lathe, care is taken to have the groove in correct alignment with the tools. It will be noted that the base is supported by a carrier on tail-stock centre. One side of groove is first under-cut, then the other side, the same tool being used. The stops at front of the cross-slide regulate depth of cut. The saddle is then moved into position for waving. A roller projects from the saddle and is held against the cam by a weight and spring attachment which causes the saddle to oscillate and imparts the contour of the cam to the wave. The right-hand tool is used for waving and the stops already referred to control depth of cut.

Heat Treatment.

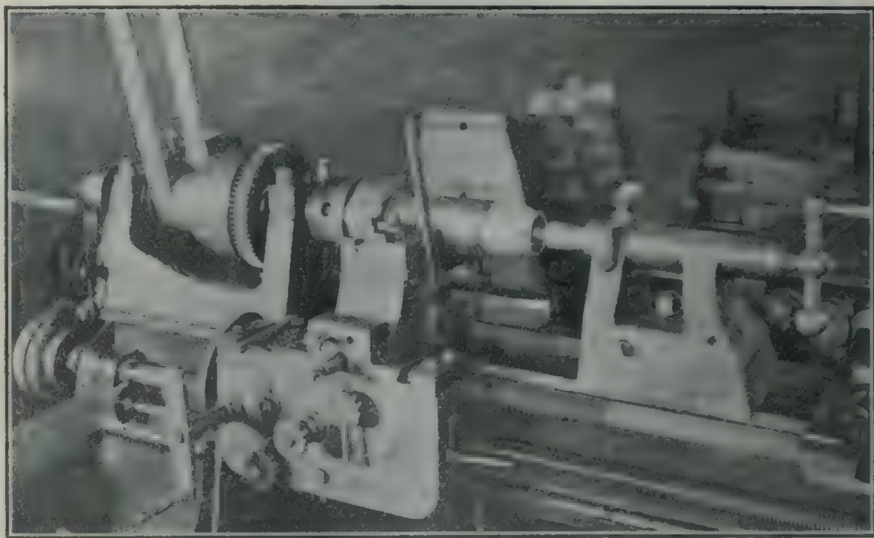
The practice followed on this plant is to have the maximum degree of hardness allowable at the set-up point, which is 1½ in. from inner side of groove, and is the point of greatest stress. By this means, the shell is made gradually softer towards the ends, particularly the nose. To obtain this result the shells are heated twice in the tempering process, each end being treated separately. A Canadian Hoskins' electric pyrometer is used in connection with the furnaces.

For the hardening process, the shells are heated in a Chapman gas furnace at a temperature of 1,600 degrees Fah. for about four minutes. The furnace contains molten lead and the shells are inserted base down and immersed in the lead within a



HEAT TREATING DEPARTMENT.

short distance of the nose. They are cooled in an oil tank equipped with a special holding carrier which enables them to be moved about in the bath to equalize the cooling effect of the oil. The illustration shows the carrier, after being lifted out of the bath after the shell has been cooled. The degree of hardness at this stage is between 60 and 75. The



OUTSIDE BODY FINISHING.

shells are now dipped in a soda bath to remove all traces of oil.

Tempering.

In the tempering process, the same type of furnace is used. The shells are first placed in the molten lead nose down for about half a minute. They are then reversed and put in base down for about the same length of time. In both cases, the shells are immersed to within about ½ in. either way of the set-up point, and the heat from the treated sections gradually spreads towards the set-up point, this giving the required degree of hardness. The limits for hardness at the set-up point now range between 45 and 53 on the scleroscope.

Scleroscope Test.

After heat treating, the base of shell is polished on a grinder in order to detect any cracks or flaws that may have originated during the forging process. The shell is now tested by the scleroscope at the set-up point for hardness. The method used is the three-point suspension, a narrow V-block being placed under the set-up point and an ordinary rest at the nose end. By this method the shell is supported directly under the point where the blow of hammer falls and the shell rests solid on the V block, thus tending to give a more consistent reading on the scale. The scleroscope in this case has the air valves operated by a foot attachment thus leaving the operator's hands free. A test piece is machined out of one shell of each batch and sent off to be tested by Government inspector.

Nosing Operation.

The next operation consists of closing in the nose which is performed on a large power press. The nose end of shell is first heated in molten lead in a gas furnace seen to the right of the illustration. The diaphragm is next dropped in and shell placed in the press. A hollow cone shaped die attached to the ram on descending closes in the nose.

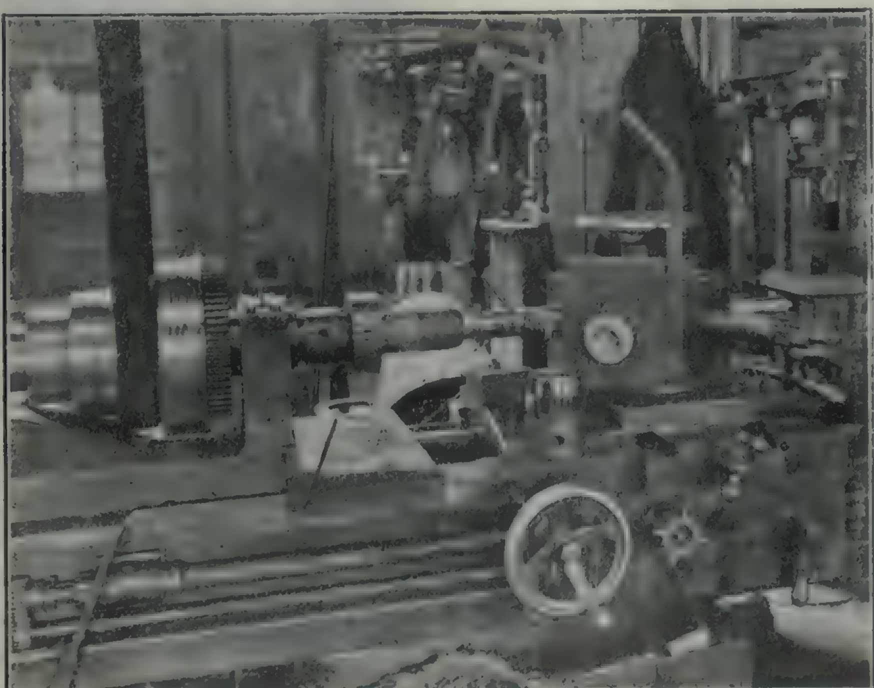
Turning and Threading Inside of Nose.

A Flather engine lathe fitted with a turret is used for turning the inside of nose and threading same. The shell is held in a collet chuck, part of which will be seen on the slide in the illustration. The first tool machines the inside face of nose, and the second tool faces the end of shell to correct length. The third tool, the square shaped fixture in front on the turret, bores the inside of nose body. The boring bar is fitted with cutter and on the bottom of the fixture is a roller for engaging with the cams

shown fastened to the bracket on the lathe bed between projecting ends of saddle. When in operation the handle shown on the fixture holds the roller up against the cam and so follows the cam outline which gives the desired form to the nose. The fourth tool is seen in operation in the illustration and is a collapsible die for threading nose.

Rough and Finish Turning Body.

The next two operations are practically identical being performed on the same type of machine, namely a standard engine lathe equipped with a special attachment. In one lathe a roughing cut is taken on the body and nose, followed by the finishing cut performed in the same manner. A threaded centre is screwed into the nose and the base held in a collet chuck. The correct profile of the shell is taken care of by the cam attached to the lathe bed and shown in the illustration between the saddle and tailstock. The tool holder is attached to the cross slide and the vertical lever pivoted to the saddle is used for drawing the tool back from the work. To the back of saddle is attached a weight hanging over the lathe bed. This weight holds the roller attached to the slide rest, up to the cam, the tool thus following the direction given by the cam. The saddle is operated in the usual manner by the lead screw. The finishing operation is performed in exactly the same manner except that the cut is of course lighter.



TURNING AND THREADING INSIDE OF NOSE

Grinding.

An alternative operation has been adopted for the finishing cut which has materially increased the output. This consists of a Ford-Smith grinder equipped with a special grinding wheel made to the same shape as shell body and nose as will be noted in the illustration. The shell is held in a chuck and threaded centre, and is revolved by belt on the left, the grinding wheel being operated by belt on right hand.

TURNING AND FINISHING COPPER BAND.

Inspection and Marking.

The shells are now gauged all over and weighed, and are then taken to the Holden-Morgan marking machine where the markings are stamped on the body. This is a simple operation. The shell is laid on two horizontal rollers and a circular steel stamp is pressed on the body by means of a vertical hand screw. The die is given an oscillating motion through a pulley and belt, the travel of the die being sufficient to make the necessary markings. The shell is now thoroughly cleaned and taken to the band press.

Copper Band Pressing.

The next operation consists of pressing on the copper driving band. A hydraulic press equipped with special fixtures designed by the Chapman Double Ball Bearing Co., is used. The power for the press is obtained from a continuous running, belt driven, pump located conveniently. The copper band is first fitted into the groove. The shell is then placed in the press, band end up, with nose resting on the spacer. Power is applied to the ram underneath the table (see illustration) which rises and forces the steel taper wedges, eight in number up into the hollow conical steel casing at the top. The wedges conforming to the required circle are thus pressed in equally against the copper band. The pressure is then released, the table falls and the shell is readily taken out. The press is operated by lever shown at left hand side, the pressure gauge being located behind.

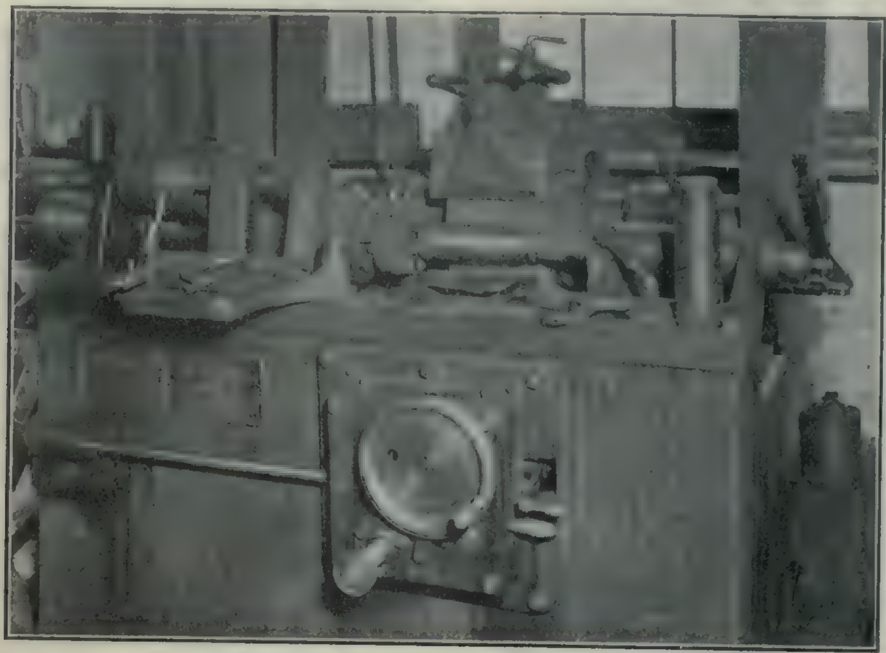
Copper Band Turning.

The copper band is machined on an ordinary engine lathe, the base of shell being held in a collet chuck and the nose end in a bell centre. The slide rest has back and front tool fixtures with tools made to the shape of the band. The back tool makes the roughing and the front tool the finishing cut. The stops shown in front of slide regulate the feed of the roughing cut and a similar stop at the back performs a similar service for the finishing cut.

Assembling.

The shell is now ready for filling and for this purpose is taken to a bench.

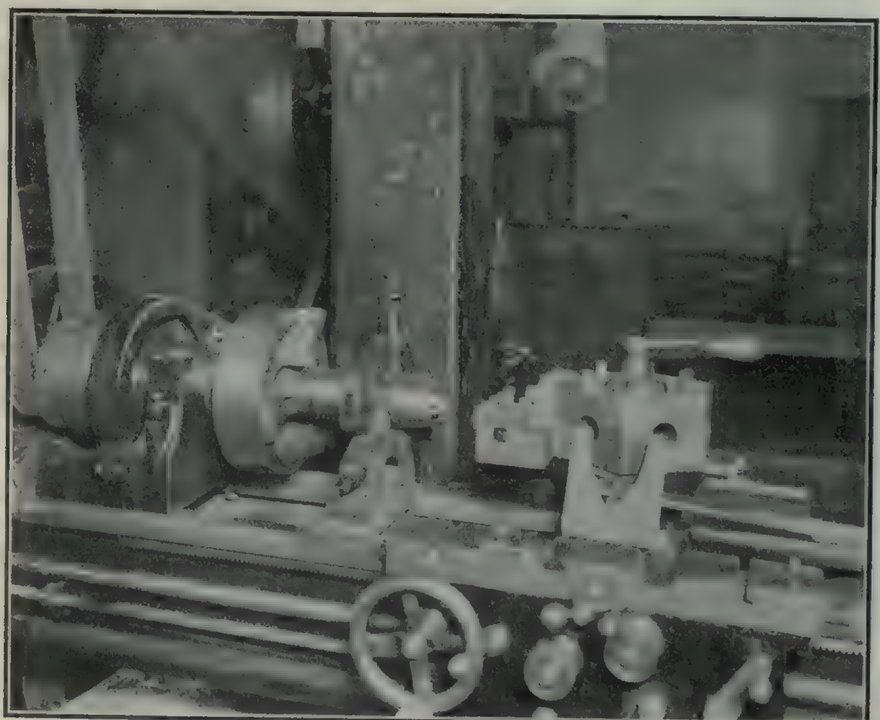
where the powder cup is first dropped in and fuse tube screwed into the diaphragm. The shrapnel bullets are then poured in, a special vibrator being em-



GRINDING OUTSIDE OF SHELL BODY.

ployed for packing them closely. The shell is now weighed after which hot resin is poured in, small shot being used to adjust the weight.

The next operation consists of screwing in the brass sockets. For this the



MACHINING BRASS SOCKETS ON SHELL NOSE.

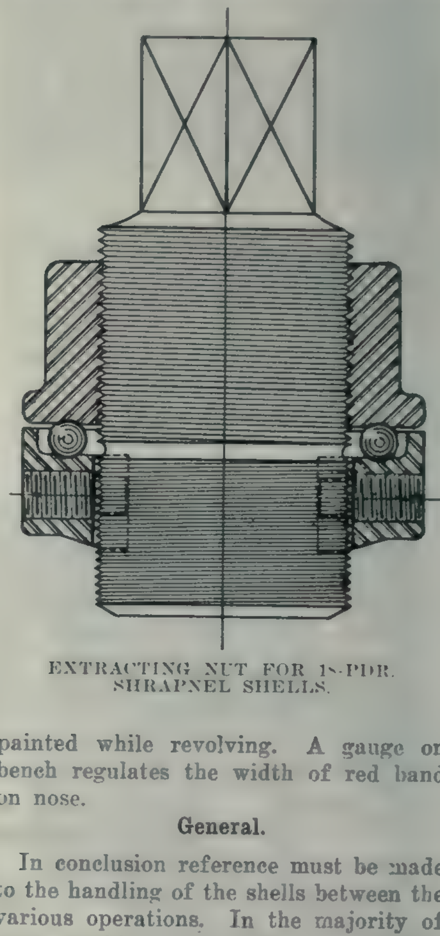
shell is held in a special bench chuck and the socket screwed in by means of special ball bearing tightening nut. This nut was designed by the Chapman Ball Bearing Co., as was also the extracting nut for use in the event of any socket having to be removed which, however, is not often the case. The fuse tube is next soldered to the socket which completes the assembly.

Turning Sockets.

The next operation consists of turning the outside of socket to conform to the contour of nose. An engine lathe equipped with a turret is used for this work. As will be seen from the illustration, the shell is held in a universal chuck with a carrier on lathe bed to steady the shell. One cut is made to gauge shown on slide rest. In the next operation the inside of socket is cleaned up and end of fuse tube cut off. This work is done on an engine lathe with ordinary tool holders and carrier for shell as in the previous operation.

Final Inspection and Painting.

The shells are now cleaned and handed over for Government inspection where they are weighed and gauged, and the brass plug put in. The final weight must be within four drams either way. The final operation consists of painting the shells. For this purpose a revolving cup is installed on a bench into which the shell is put with the nose down, and



EXTRACTING NUT FOR 18-PDR. SHRAPNEL SHELLS.

painted while revolving. A gauge on bench regulates the width of red band on nose.

General.

In conclusion reference must be made to the handling of the shells between the various operations. In the majority of cases machine shops have been adapted to the manufacture of shells and not laid out specially for this purpose. It therefore follows that the machines are not always installed in their proper positions to correspond with the sequence of operations. This necessitates considerable handling and often unavoidable loss of time. This loss, however, has been considerably reduced by the use of trucks made by the Chapman Double Ball Bearing Co., these trucks having several features which make them of great utility, especially when being operated in confined spaces.

Throughout all the operations, the shells are carefully gauged with limit

and various other types of gauge to ensure the greatest possible accuracy. The final weight of the shells must be very exact, it therefore follows that great care must be taken in all the machining

SHELL TRANSPORTATION EQUIPMENT SHOWING ELEVATING TRANSFER TRUCK

operations to have the tools set accurately so that the shells conform to the gauges which are made to fine limits.

ESSENTIAL PRINCIPLES OF ENGINE DESIGN.

A COMPREHENSIVE paper, entitled the "Essential Principles of Engine Design," was read before the Manchester Association of Engineers recently by Mr. Frank Foster, M.Sc. The author submitted certain considerations and data suggested by practical experience, with the object of supplementing and modifying text-book information, so as to render it more practical and more in accordance with the tendencies of modern engineering progress. The paper brought forward three main lines of thought which the author considered engineers would find valuable in practice, namely:

(1)—The law of similarity, which might be stated generally as follows: Similar machines copies of each other to different scales and working under like conditions were equally strong in all parts, and gave similar quality of operation.

(2)—By attention to details, particularly in valves and valve gears, speeds of rotation could be increased so as to secure to a considerable degree the merits of a high revolution speed without giving up the special features which had made the slow-speed reciprocating engine the standard, where the best in respect of economy, durability, reliability and quality of operation were desired.

(3)—Each detail of engine design was worthy of and would amply repay close, patient, scientific and workshop study.

Principle of Similarity in Design.

Pursuing the above lines of thought, more especially with reference to the development of a line or series of engines of one type, the paper was divided into a number of sections, commencing with one on the principles of similarity, which the author considered should at least be the basis of the whole series of designs, instead of as was usual at present, each design being a strange piece of original patchwork laboriously contrived with the aid of as many parts from other designs as it was possible to make use of. Taking a concrete case, the author said that if one engine was copied from another in all details, but to a different scale, and worked at the same piston speed and under the same steam pressure, it would have precisely the same strength in all parts as the corresponding parts of the original engine.

Whenever another size of engine had to be designed it was made as a copy of the standard, but with all dimensions increased or diminished in a certain ratio. This ratio was determined by the power of the engine. Thus, if the standard engine happened to be 750 indicated horse-power at 80 revolutions per minute and 4-ft. stroke, an engine of 1,160 indicated horse-power would run at 64 revolutions per minute and have a stroke of 5 ft. The ratio of the strokes was found to be 1.25. Then every dimension of the new engine would be 1.25 times that of the standard. The weight of the new engine was greater than the weight of the standard in the ratio of the cube of 1.25—that was, in the ratio of 1.953—whilst the power was greater in the ratio of the square of the primary or stroke ratio—that was, in the ratio of 1.562. Thus, the standard engine power being 750 at 80 revolutions per minute and 4-ft. stroke, and the new engine 1,160 indicated horse-power, the ratio for the scales was—

$$\sqrt{\left(\frac{1160 \text{ I.H.P.}}{750 \text{ I.H.P.}}\right)} = 1.25.$$

The new engine was consequently an exact copy of the standard, but with every dimension increased 25 per cent. and its weight increased in the ratio of 1.25 cubed, or 1.953. The copying process, it was explained, served for all details, including metal thicknesses and bolt sizes.

Catalogued Machinery and Design Similarity.

The author then proceeded to analyze examples of machines listed in published catalogues to see whether the designers had consciously or unconsciously adhered to the law of similarity. The articles dealt with included steam-driven, air and circulating pumps, superposed compound steam engines, large continental gas engines, small horizontal gas engines. From a study of these examples, the author concluded that as regards weights and strengths the rule of similarity gave perfectly satisfactory working engines of the same type, but widely different sizes, and that there was no inherent necessity for the extra weight frequently put into small engines.

Discussing the reasons for departure from the rule of similarity, the author gave the following:—(1) No conscious attempt to adhere to it; (2) a designer accustomed to a limited range of scantlings instinctively feared to adopt others very much thinner, even for proportionately smaller machines; (3) molders demanded a margin for contingencies, meaning chiefly their own lack of adaptability and limited range of manual skill; (4) the tradition in general engineering shops that the British fitter was too clumsy to be trusted with a spanner or bolt less than ⅜ in.; (5) on rubbing surfaces certain allowances were made for wear which were not strictly proportionate to the scantlings; and (6) allowances for corrosion. Reviewing the above reasons, the author maintained that departure from the rule is only justified by lack of skill.

Modifications Relative to Similarity.

Admitting that for the time being strict adherence to the rule of similarity

was rarely possible, the author then laid down the modifications which seemed desirable:

(1)—A standard engine of fair size should be accurately designed in all its details.

(2)—The leading dimensions of this standard should be so chosen with reference to the smallest and largest of the series that the rule of proportionality applied to the overall dimensions and leading "centre to centre" dimensions.

(3)—The stroke of the engine should be the starting point and the cylinder diameters should be as nearly as possible in strict ratio with the stroke.

(4)—The details should follow the law of similarity, except that, where thought necessary, the ratio might be slightly increased or decreased to meet the obstacles already mentioned. Thus, if for a small engine the true proportionate ratio were 0.4 and it were deemed desirable to strengthen the parts by 20 per cent., the linear dimensions should be increased 10 per cent. so that the factor became 0.44. For instance, if the standard engine cylinder metal, frame thickness, piston-rod diameter and main neck diameter were respectively 1.5 in., 1.3 in., 6 in., and 16 in., the corresponding dimensions on the smaller engine became 0.66 in., 0.57 in., 2.64 in., and 7.05 in.

(5)—One objection to the change of ratio described above was that it tended to overthrow certain of the overall dimensions unless these were unduly liberal on the standard engine. This became important where the number of sizes was large, and called for a modification in one or two dimensions. It did not, however alter the main course of procedure in designing and estimating.

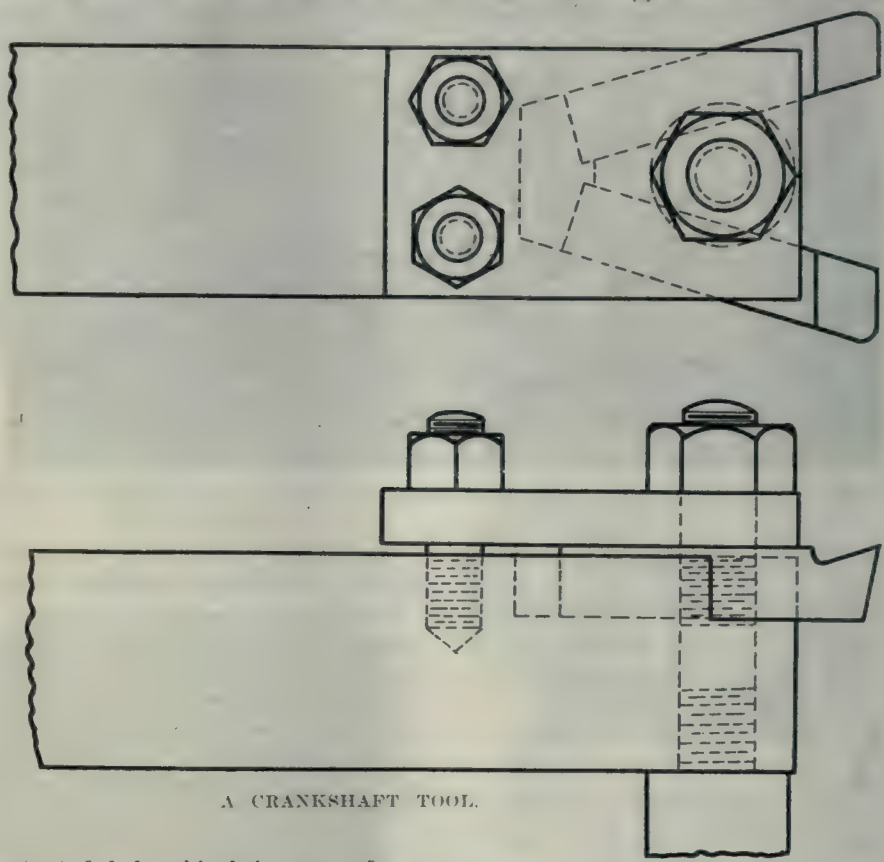
The remainder of the paper dealt with steam consumption, indicator diagrams, cylinder ratios, stresses, frames, flywheels, bearings, pistons, foundations, materials of construction, and commercial and market considerations. — The Engineer.

A CRANK SHAFT TOOL.

By D. S. Mann.

IN the illustration is shown a convenient lathe tool for turning the inner sides of the cheeks of gas engine crank shafts. The usual practice is to rough down either side with a right and left-hand tool, taking each cut separately, and, when the lathe is sufficiently heavy to pull the two cuts, considerable time is saved by the use of the double tool. It is also possible to make this tool much heavier and stiffer than the single tool.

Making the cut on both sides serves to take up the thrust of the tools, balancing same, so that the tools cannot be pushed out of the cut with consequent chattering. The tool bits, being set in at an angle, have quite a bit of adjustment for width of cut, although it is preferable to have a separate tool for each size of shaft. With most of the shafts now used it is only necessary to take a roughing cut down the inside. The length of the shank of the tool, of course, depends upon the throw of the crank being turned, and may be of cold-drawn steel of the proper size. Maintenance in position is by means of two bolts and a heavy strap, while a heavy post of the proper length to rest on the saddle is screwed into the bottom of the front stud hole, this being tapped entirely through, forming a very rigid combination, and one which will give satisfaction.



A CRANKSHAFT TOOL.

While on the subject of crank shafts, the general practice when turning the body of the shaft is to use a small jack or screw between the cheeks to prevent springing-in. This jack is often set up a bit too tightly, thus doing the very thing it is designed to prevent. The writer has found that a better method is by the use of two heavy strap clamps, these being placed across the cheeks and tightened up before the shaft is placed in the lathe. A good idea is to have a serrated hardened plug in each end of the clamps, so as to secure a good "bite" on the sides of the cheeks; a sharp-pointed screw may also be used. Two clamping bolts, close to either side, will not tend to bend the clamps as readily as one bolt in the centre.

EMBARGO ON METALS RELAXED.

A RELAXATION of the rigid regulations governing the exportation of Canadian goods to guard against their finding their way to the enemy is taking place along certain lines. In certain cases, where deemed advisable, the Customs Department is issuing special licenses allowing the exportation of certain articles otherwise prohibited in the recent revision of the enemy trading proclamations.

A notable instance is in the case of ores, such as copper and lead. Their exportation to the United States is being allowed under special license where it is established that they will not ultimately find their way into the hands of the enemy. As a rule, licenses will be issued to permit the exportation of goods now allowed to be exported only to British territory to the Allies as well. Other such licenses will be issued permitting export to the United States. These licenses are not issued to all shippers, but only to those who can be trusted to see that the goods exempted do not reach hostile countries.

Large quantities of goods shipped contrary to the regulation have been, and are being, turned back at the border. So far the practice has been simply to hold them up, neither confiscation nor prosecution following. All this has meant a considerable additional volume of work for Canadian Customs officials.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

PROJECTILES.

A PROJECTILE is any body that is thrown into the air; in other words, it is moved partly or wholly by an impulse that has been given to it. Any projectile is acted upon by two forces—namely, the original force of projection which tends to keep it moving with a uniform motion in a straight line and the force of gravity which gives it an ever increasing velocity towards the centre of the earth. A baseball thrown by the hand, a stream of water from a nozzle, a rifle bullet and a shell from a cannon are common examples of projectiles.

The trajectory of a projectile is the height to which it rises above the point of discharge in order to cover a specified distance. For instance, the trajectory of the British service rifle at a range of one mile is 17 feet, while that of the Ross rifle is somewhat less. The maximum height to which a projectile will rise is determined by its initial velocity and the angle at which it is projected. In the case of heavy ordinance, a high initial velocity is very destructive to the rifling of the gun, thus the life of a heavy, expensive gun would be greatly increased by using small powder charges and firing at a high angle rather than using heavy propelling charges with a low trajectory.

Theoretically the greatest range is obtained by discharging the shell at an angle of 45 degrees with the horizontal, but this is altered somewhat in practice by the resistance of the atmosphere and other causes. Where heavy naval guns are worked at extreme ranges, the shells necessarily go to a considerable height, so that they fall on the deck of the enemy ship rather than pierce her side armor. Under such conditions the range is the most important information to be obtained. It is comparatively easy to place a shot directly in line with the target, but another matter entirely to drop it at such a distance from the gun that it will fall on the deck of a ship. For this reason ship captains endeavor to attack each other at long ranges, broadside on rather than end on, as in the case of a pursuit. The study of projectiles is so closely allied to that of falling bodies that it will be in order to work a few problems pertaining to this branch of the subject.

• • •

Question.—A body moves at the rate of 2,400 feet per second. How far will it go in 2.72 minutes?

Answer.—In one minute, the distance traversed is $2,400 \times 60$. In 2.72 minutes the space passed over is $2,400 \times 60 \times 2.72 = 391,680$. In larger units this becomes $\frac{391,680}{5,280} = 74.18$ miles.

• • •

Question.—What velocity in feet per minute is equivalent to a mile a minute?

Answer.—A mile per minute equals 5,280 feet in 60 seconds, or is $\frac{5,280}{60} =$ 88 feet per second.

• • •

Question.—A bomb falls from an aeroplane at a height of 3,800 feet. How long will it take to reach the earth?

Answer.—Formula, $t = \sqrt{\frac{2h}{g}}$, in which t = time in seconds, h = height in feet, and g = force of gravity = 32.16 pounds. Applying the formula, $t = \sqrt{(\frac{2 \times 3800}{32.16})}$ or $t = \sqrt{236.3184} = 15.37$ seconds.

• • •

Question.—An aerial scout shoots vertically downward at an enemy, but misses him, and the bullet strikes the earth. If the initial velocity of the bullet be 2,400 feet per second, and it is fired from a height of 5,240 feet, at what velocity will it strike the earth?

Answer.—To determine the velocity acquired by a body in falling from a given height, the formula is, $v = \sqrt{2\,g\,h}$, where v = velocity in feet per second, g = force of gravity = 32.16, and h = height in feet. In the above example, velocity $= \sqrt{2 \times 32.16 \times 5240} = \sqrt{337,036} = 580.55$ feet per second. The initial velocity of the bullet is 2,400 feet per second, therefore velocity with which it strikes the earth is $580.55 + 2,400 = 2980.55$ feet per second.

• • •

Question.—A pipe is under water pressure of 60 pounds per square inch. If a suitable nozzle be fitted and directed vertically upwards, neglecting friction, to what height will the water rise?

Answer.—The head of the water in feet $= \frac{60}{.434} = 136.17$ feet. Theoretically, the water would rise to the same height.

• • •

Question.—A dirigible going at the rate of 90 miles per hour wishes to drop a bomb upon an arsenal 3,000 feet below. How far from the perpendicular would the airship have to be at the time of releasing the missile in order to hit its mark, and at what angle to the vertical would the sight be set to accomplish this?

Answer.—The time required for a bomb to drop 3,000 feet is $t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 3000}{32.16}} = 13.66$ seconds. When going 90 miles, the speed per second $= \frac{90 \times 5280}{60 \times 60} = 132$ feet per second.

In 13.66 seconds the distance traversed is $132 \times 13.66 = 1803.12$ feet—that is, the missile would travel this horizontal distance after leaving the baloon.

The vertical distance being 3,000 feet and the horizontal distance being 1803.12 feet to the target at the time of discharge, the tangent of the angle will have to be $\frac{1803.12}{3,000} = .60104$. From a table of tangents we find this angle to be 31° 1′, or approximately 31 degrees.

• • •

Question.—If the muzzle velocity of the British service rifle is 2,200 feet per second and that of the Canadian Ross is 2,600 feet per second, what would be the difference in the range when the shots are discharged horizontally, four feet from the ground?

Answer.—Neglecting air resistance, the time required by the bullet to drop 4 feet $= t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{8}{32.16}} = \sqrt{.2487} = .498$ second. At the rate of 2,200 feet per second, the distance traversed in .498 second $= 2,200 \times .498 = 1095.6$ feet. With a muzzle velocity of 2,600 feet per second, the range will be $2,600 \times .498 = 1294.8$ feet.

• • •

Question.—An airship is 300 feet long, and is flying a mile high at the rate of 80 miles per hour. Assuming that the muzzle velocity of an aero-gun projectile is 2,800 feet per second and that the shooting is practically in a vertical direction, how far ahead of gas bag should the gun be aimed?

Answer.—The total height to which the projectile will go

$$h = \frac{v^2}{2g} = \frac{2800\times2800}{2\times32.16} = 121{,}890.5 \text{ feet, and the}$$

time required to make the total height is

$$\sqrt{\frac{2h}{g}} = \sqrt{\frac{121890.5\times2}{32.16}} = 87.06 \text{ seconds.}$$

The difference between the height of the balloon and the maximum altitude of the projectile is 121,890.5—5,280=116,610.5 feet. The time required by the projectile to traverse this distance is

$$\sqrt{\frac{116{,}610.5\times2}{2\times32.16}} = 85.15 \text{ seconds.}$$

The time taken by the shell to reach the balloon is 87.06 — 85.15 = 1.91 secs. A rate of 80 miles per hour gives a speed

$$\text{of } \frac{80\times5280}{60\times60} = 117.3 \text{ feet per second.}$$

The distance traversed in 1.91 seconds is 117.3×1.91=223.043 feet. If the gunner aimed about one-third of a length ahead of the airship, he would probably hit it in the centre.

* * *

Question.—The maximum angle of elevation of a British naval gun is 15 degrees. If the muzzle velocity of the shell is 2,400 feet per second, what is its maximum range?

Answer.—The horizontal velocity of the projectile is 2,400×cosine of 15 degrees = 2,400×.96593 = 2318.23 feet per second.

The initial vertical velocity = 2400× the sine of 15 degrees = 2,400×.25882 = 62.17 feet per second.

The height to which the shell will go

$$\text{will be } h = \frac{v^2}{2g} = \frac{621.17\times621.17}{2\times32.16} = 5998.94$$

feet.

The time required to rise to this

$$\text{height is } t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times5998.94}{32.16}} =$$

$\sqrt{373.06} = 19.3$ seconds.

The time required to go up and come down is 2×19.3 = 38.6 seconds, which is the total time of flight. The range or distance traversed = 2318.23 × 38.6 = 89483.678 feet, or 16.94 miles.

Propeller Flutter.—The vibration of the wooden blades of aeroplanes is termed "propeller flutter." The air resistance of a propeller is proportionate to the blade thickness, and, as the flutter is equivalent to an increased blade possible. A great deal of the success of the Gnome engine is due to the fact that its smooth running reduces flutter to a minimum.

ELECTRIC DRIVES FOR LATHES.

IN order to secure maximum and best output from modern tool steels and machine tools, it is necessary, says a writer in "Electricity," that the cutting and feed speeds be proportioned exactly to the materials and operations concerned. Electric driving makes possible accurate and continuous speed control over a wider range than can be compassed by any other means applicable to machine tools, and this in itself is a most important factor in determining the value of electric motors in machine shops.

To take a particular example, a five-step cone pulley and back gear driven from a constant speed line shaft gave, in a certain lathe, spindle speeds of 9, 15, 25, 40 and 60 revs. per min. with back gear in, and 110, 175, 300, 450 and 650 revs. per min. with back gear out; but, by substituting a shunt wound motor (with 2 to 1 speed range by field regulation) for the line shaft drive, absolately continuous speed regulation was obtained from 9 to 12,000 revs. per min. The practical advantage of this complete and accurate speed gradation needs no emphasis.

Alternative Systems.

In any workshop where it is proposed to employ electric motors two alternative systems have to be considered. Each machine tool may be driven by its own motors or a number of tools may be belt driven in the ordinary way from a line shaft which is itself electrically driven. Group driving is particularly useful where a number of machines of similar type are in service at the same time and can be driven from a relatively short line shaft, sufficient speed control being obtainable by belt and cone pulley driven from the line shaft, the speed of which is kept constant.

For group driving, a standard shunt wound direct current or squirrel-cage induction motor is suitable, and the motor is considerably lighter than one with widely variable speed. Further, where group drive is practised, the motor horse-power required is less than the sum of the horse-powers of motors used for individual driving, the reason being that, when each tool has its own motor, the latter must be powerful enough to overcome the starting or other high temporary resistance of the tool, whereas, in a group-driving system, the percentage value of individual peak loads is much reduced, and the peaks on some machines are often compensated by reduced demands on the others.

For individual driving of machine tools there may be used either a variable speed motor directly belted or geared on to the machine, all speed variation being obtained by regulating the motor field: or an induction motor or a standard shunt motor, with change-speed pulleys or gears for coarse speed regulation, and 2 or 1½ to 1 field variation for fine speed adjustment. In the former case, a semi-enclosed, interpole shunt motor is suitable and provides high torque and wide speed variation with little sparking at the brushes.

Where the whole speed range is obtained by motor regulation, rapid speed changing is possible over the whole range, and complex and cumbersome mechanical change-speed devices are unnecessary. On the other hand, a shunt motor with small speed range by field regulation is a lighter and cheaper machine, and, by combining it with change-speed pulleys or gears, very wide speed range can be covered with little trouble or delay. This arrangement is at once applicable to any existing or new machine tool designed for line-shaft driving. The flexibility and smooth running of the belt drive are important advantages and vibration is much less pronounced and injurious than it is apt to be if the motor be gear coupled and mounted on the frame of the machine tool itself.

Horse Power Feature.

As regards the horse-power required, this varies enormously with the design of the machine tool and the exact materials and speeds concerned. By driving the tool temporarily by a motor which is certainly too large, the best working conditions can rapidly be determined and the power requirements measured electrically. This is a matter for the machine tool makers (except in cases of converting drives), but there is still noticeable a tendency to use motors of too low horse-power.

The introduction of special alloy steels has led to cutting speeds of from 80 to 160 ft. per minute, and finishing speeds up to 200 ft. per minute, and the quadrupling of the speeds formerly used for carbon steel demands an increase in driving power, the magnitude of which is apt to be overlooked where machines are driven in groups from line shafting and spare power is available and frictional losses high, so that a percentage increase in the useful power is less noticeable.

Hardening Hammer Face.—To harden hammer face, heat the hammer to a bright red all over, dip the face into the bath about ¾ in., moving it about the surface the while about half a minute, remove from bath and rub the face bright, dip the nose of hammer about ½ in. till the face has drawn to a deep straw color, then cool the face and draw the nose down to blue, and cool altogether. If done properly, a hammer tempered in this way will be right for years.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

BAND PRESS FOR SHRAPNEL AND HOWITZER SHELLS.

IN connection with the manufacture of shrapnel and howitzer shells a banding press has been designed and is being built and put on the market by the Jenckes Machine Co. of Sherbrooke, Que., for the purpose of pressing the copper band into place in the grooved recess on the shell body.

The base or stand of this press is a heavy substantial grey iron casting, with a raised portion on which a ring rotates. This raised portion is slotted for six steel plungers, which are machined to bear on wedge-shaped recesses in the ring. The inner dies which actually press the copper band are machined as one piece, and afterwards cut in six sections, these being loosely pinned to the plungers to keep them in their relative positions. The plungers are all returned after the movement of the ring by means of the springs shown. The main lever and the toggle lever are steel castings.

The whole arrangement is operated by means of a 12-in. air hoist cylinder, controlled by a four-way valve, which permits quick and positive action. The air hoist cylinder is riveted to the main base in such a way that the cylinder carries the motion of the lever without any tendency to cram.

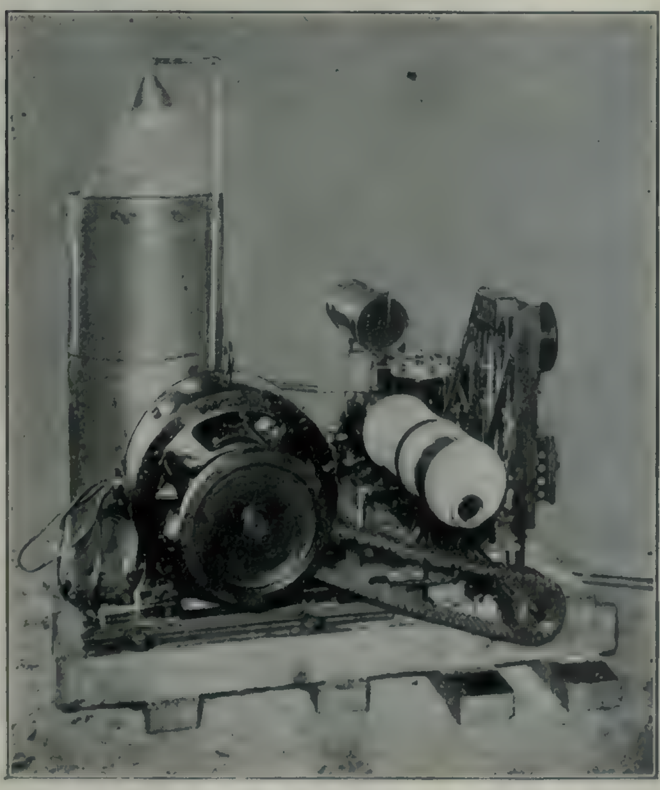
BAND PRESS FOR SHRAPNEL AND HOWITZER SHELLS.

X-RAY OUTFIT FOR OVERSEAS EXPEDITIONARY FORCE.

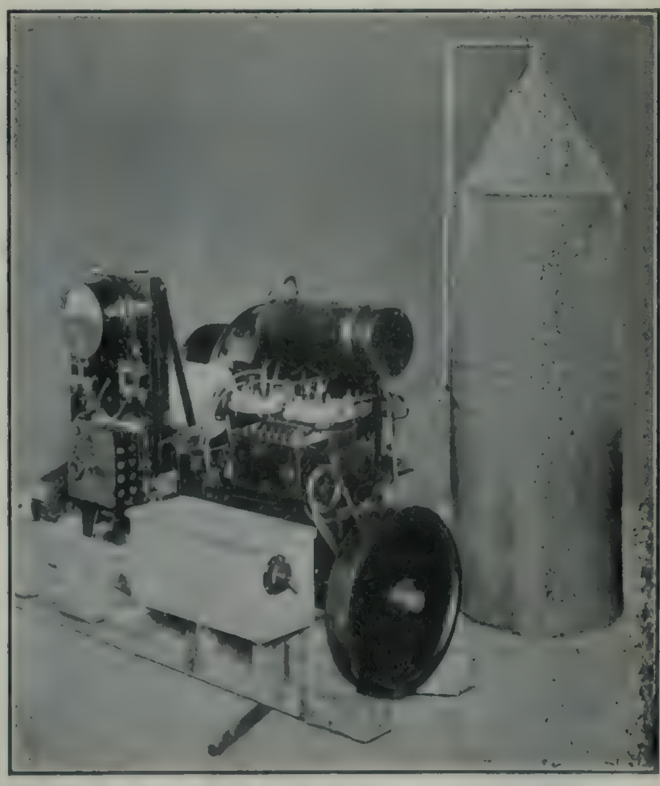
THE University of Toronto, No. 4, General Hospital, has recently had built for service with the Canada Expeditionary Force at the front, a semi-portable generating set for an X-ray outfit. This is a somewhat unique installation, and the accompanying illustrations show clearly the general lay-out.

The unit was constructed by the Canadian Fairbanks-Morse Co., of Toronto, and will be used to generate electric current for the X-ray machines. The combination consists of a 12-h.p. type "G" Fairbanks-Morse marine engine, arranged with throttling governor, coupled to a short steel shaft, having an outboard bearing, taking the chain pull. The generator is a 7½ k.w. direct-current machine, wound for 230 volts, and the drive is by means of a silent chain at 30-in. centres, current from the dynamo being delivered to a slate switchboard carrying the field rheostat and voltmeter. Two feeder-switches permit of handling two X-ray machines at the one time, and a Maxim silencer takes care of the engine exhaust.

It will be noted from the photographs that the engine is arranged with "Bosch" high tension ignition (duplex), and that the starting battery, switch and tools are all carried in one box securely fastened to the side of the en-



X-RAY OUTFIT FOR CANADIAN OVERSEAS EXPEDITIONARY FORCE.



X-RAY OUTFIT FOR CANADIAN OVERSEAS EXPEDITIONARY FORCE.

gine. A "Detroit" mechanical lubricator is fitted to all bearings. The fuel tank is carried on top of the outfit on the carburetor side and holds four gallons. The cooling of the engine is taken care of by a galvanized tank, 20 in. x 5 ft., with a cone-shaped screen at the top, the circulating pump taking the water from the bottom of the tank, and passing it through the engine jacket to the top of this screen, where it is aerated while passing back to the tank.

The entire combination unit is mounted on a scantling frame, and when crated has an over-all dimension of about 5 ft. 6 in. x 5 ft. 3 in., with a height of 36 in. The current produced is notably steady, and the plant, being self-contained, can be placed and put in operation in a few minutes.

FOUR SPINDLE VERTICAL SQUARE-HEX ATTACHMENT.

THE illustrations here show a four Spring Vertical Square-Hex Attachment for Milling Machines, to take care of such work as hexing of spark plug nuts, squaring of screw or bolt heads, straddle milling, and all such classes of work as come within its capacity. The attachment can be arranged for holding the work either by double taper contraction collets, operated by a wrench as shown in Fig. 1, or on threaded arbors or plugs, as shown in Fig. 2, the pieces being run up tight against the hardened steel washers or collars by a special "Shaw" wrench, which is also used for taking off the finished work without bruising. Through the indexing handle, the four spindles, which are geared together, are turned to index for square or hexagon work, and the vertical lever shown, Fig. 1, below the attachment, is arranged to eject the finished work after unclamping the collets.

The attchment is made with a $1\frac{1}{2}$ in. collet capacity, having a center distance, spindle to spindle, of 3 inches, and is an addition to the line of Multiple Spindle Index Centers of The Garvin Machine Co. New York City.

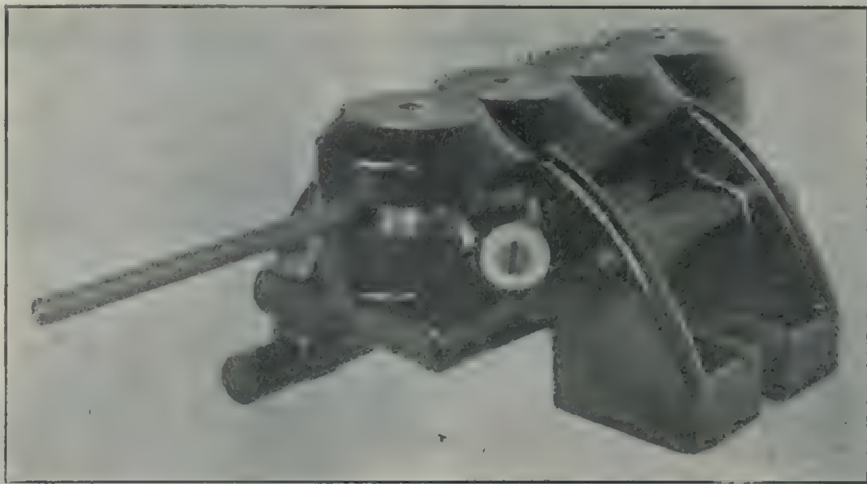


FIG. 2. FOUR-SPINDLE VERTICAL SQUARE-HEX. ATTACHMENT.

DRIVING CONTACT OF TOOTHED WHEELS

IN good work, the principal driving of toothed wheels is effected by contact at and near the pitch line. When this is completely secured the amount of sliding upon the working faces of the teeth is almost negligible, and the resulting wear is insignificant in amount. in course of time, however, the loss of material becomes apparent, and the teeth begin to bear more upon the points.

Within moderate limits this is quite in order, but in some cases it may extend so far as to show the heaviest bearing near to the extreme points of the teeth, in which case such surfaces should be lightly chipped to clear, and thereby largely reduce the liability of teeth to break off at the root. By a firm adoption of this course many wheels have been saved from premature collapse, after repeated breakage of single whole teeth.

Concentration of pressure at either end of the tooth is also attended with liability to cause fracture. The cutting of wheel teeth in a reasonably good machine leaves the teeth practically true as to squareness with regard to the side faces of the wheel. Uncut teeth are, however, seldom very good in this respect, and any defect of this kind, obviously, leads to concentration of pressure at the ends, especially if the two wheels possess defects of this kind in opposite directions. It is therefore a point of simple prudence to keep the ends as well as the points chipped back far enough to avoid abnormal heavy bearing on the area affected.

Trench Periscope. — An ordinary trench periscope can be constructed from two mirrors opposed and parallel to each other, and set at an angle of 45°. The eye of the observer should be kept close to the edge of the lower mirror. The image of the reflection varies in size with the distance between the two mirrors and, owing to light losses caused by the double reflection, is apt to be indistinct. It is hardly necessary to add that the periscope of a submarine is an instrument very much more complicated and effective.

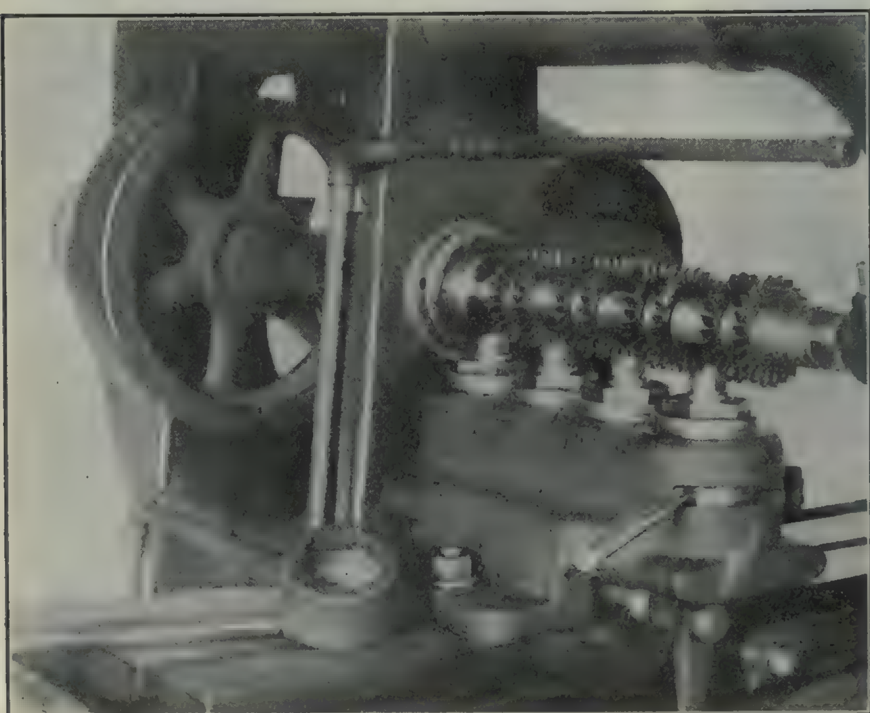


FIG. 1 FOUR-SPINDLE VERTICAL SQUARE-HEX. ATTACHMENT.

The display of practical patriotism, indicated in the accompanying extracts from the editorial columns of prominent Old Country technical journals, should be such as to inspire us to not only intensify our own individual effort in the cause, but dispose us collectively to leave no stone unturned in order that concentration and superlative efficiency be realized.

TEACHING THE MANUFACTURE OF WAR MUNITIONS.

THERE have been started at the Birmingham Municipal Technical School, says "The Engineer," special classes for the training of men and youths in the manufacture of war munitions to whom at present such occupation is wholly foreign. The idea is to assist in remedying the shortage of labor now so manifest in these trades. Already applications have been received from nearly 400 men who are desirous of assisting the country, and whose ages range from twenty-five to sixty years. It is hoped that after five or six weeks' instruction they will have learned sufficient to enable them to go into the factory.

Has Government Approval.

The idea of the classes came from the head of the engineering department at the schools, Mr. Thomas Reid, who, after a consultation with the Education Committee, visited the Admiralty offices in London and Woolwich Arsenal. The Government gave its approval to the suggestion. The classes are being started with the object of rapidly training youths and men in the making of shells and fuse parts, and it is interesting to note that the work done in the schools is not to be experimental, all the shells and other munitions produced being used by the Admiralty. One of the shops at the Technical School is being set apart for the work, and machines are being removed to facilitate the operations. In future it may be found necessary to do the work continuously, and the moulding and casting may also be done at the schools.

It is understood that all the workmen who can be released from the employ of the Birmingham Corporation are to be taken over by the local Munitions Committee, with a view to their distribution among the firms requiring them who are engaged on the making of munitions for the Government, the total number being nearly 1,200. At some of the Coventry factories where munitions are being turned out, petitions have been sent to the managements requesting them to discharge all alien workmen, and at certain shops the men have only been persuaded to remain at work on the understanding that their wishes will be carried out.

BARROW ASPIRES TO THE PENNANT.

BARROW, Eng., is very busy in the production of munitions of war, says the Liverpool Journal of Commerce, and more and more men and women are being engaged to do this work week after week. The Barrow Steel Co. have determined in the meantime to close their works to commercial business of any sort, and to devote their energies entirely to produce steel for shells, which are to be manufactured at Vickers' works and elsewhere. This will stop the Bessemer department of their works, but the rail mills, the merchant mills, and the plate mills will be kept busily employed with Siemen-Martin steel, and the men who will be thrown out of work will find employment in the various departments of Vickers' works.

Canadian Mechanics in Barrow.

A large number of men who are above enlistment age have arrived at Barrow from Canada, and they have started work at Vickers' yard. It is expected some hundreds of girls from France will shortly arrive at Barrow for war munitions work, and numerous additions to workpeople, men, women and girls are being started every day. The new shell shop is so far advanced that work is in operation in several of its departments. It will soon be ready for full work, and, when that is possible, some 2,000 hands will be employed in this shop alone, all engaged in making munitions of war.

Shipbuilding Secondary.

Much more attention is being devoted to the making of munitions of war than to the building of ships. The shipyard side at Vickers' works is running short of orders, and men who have been employed in plating, riveting, and other trades connected with shipbuilding are removing to other places, where work is more plentiful.

Barrow at the present moment is one of the busiest towns in the country engaged in munitions of war, and before many weeks are over there will be a vast increase in its production capacity. All employees engaged in this work are busy with patriotic fervor in the attempt to meet the great and growing demand for war material. Very satisfactory wages are paid to both women and men, and the consequence is that many women and girls recently employed by storekeepers are now working in the production of munitions of war.

Some time ago one of the most noticeable things about Barrow was the great dearth of employment for females. Now the reverse is the case, and many storekeepers are compelled to work the best

they can with too small a staff. This is all the more difficult to do, because with Barrow so crowded with people as it is at present, there is the greatest activity among storekeepers, who are having the time of their lives.

The town is dead set on being of the greatest service to the Government in connection with the supply of war material.

UNIVERSITY STUDENTS AS SHELL MAKERS.

THERE is a growing feeling amongst men of all grades and positions in Sheffield that, where business will possibly permit it, and army requirements cannot be satisfied, their services may be offered at the armament works. What is wanted, says a correspondent of The Engineer, is someone to organize this phase of patriotism so as to turn it to practical account. If the Government would invite them to enlist in an industrial battalion, with a definite promise on the part of employers that the old positions would be reserved for them after the war, I believe it would prove a very popular move, and one that would provide a sound reserve of intelligent, enthusiastic laborers ready, for their country's sake, to turn their hands to anything whilst the war lasts.

I have been personally approached by men who expressed a strong wish that something of that kind could be done, and if my mentioning it in this letter will help in advancing the suggestion in the right quarter I should be glad. In some cases men have four or five hours' leisure a day which they would gladly devote to such an object, and other men, as already indicated, would be prepared to drop their ordinary vocations for the time being and become armament workers. Lord Kitchener allows six months for a recruit to be licked into shape, but these men, long before the expiration of that period, would be doing very useful work and would feel that they were helping the country as much as the men in the trenches.

Organizing Munitions Production.

At a very representative meeting of traders held recently to consider how many more of their employees could be spared for service with the colors, one of the speakers, Lord Wharncliffe, said he had always been against conscription, but he thought we were rapidly approaching a time when that method—not for the army alone, but for works engaged in the production of munitions—would be the only solution of our difficulties.

At the same meeting, the Vice-Chancellor of the University announced that a number of students who were rejected last year by the army because of minor defects, had asked to be permitted to spend the whole of the long vacation in the armament works. He had, he added, ascertained, not only from the heads of the armament firms in Sheffield, but also from the Munitions Committee at the War Office, that the need of men at these works all over the country was so great that they could take all the students he was likely to send them and many more. He suggested that shop assistants who were not fitted for the army might be able to render valuable service in that direction.

NEATSFOOT OIL BELT TREATMENT

By N. G. Near.

WITH reference to P. W. Blair's article in May 20 issue of Canadian Machinery, I note what he says about Neatsfoot Oil being a good leather preserver.

Now, I do not want to take direct issue with Mr. Blair because it has been known for years that Neatsfoot Oil has much to recommend it for some treatments of leather, but the benefits show their value rather less in belt service than in other uses to which leather is put. Neatsfoot Oil is not gummy, hence it keeps the leather pliable and prevents drying and cracking, which certainly are valuable qualifications for use on belting.

The disadvantages and limitations, however, are that it is to a certain extent volatile, and contains more fatty acid than good belt treatment does, and because it is a liquid oil it tends to increase stretching and to make the leather too soft for best transmission purposes. It does not give the pliable, mellow density and strength that a real belt treatment with its heavier body gives, nor does it prevent slipping except insofar as a pliable belt slips less than a dry, hard belt. A belt treated with Neatsfoot Oil cannot be run slack under full load with the true advantages of slack running.

I call attention to these facts because I often see Neatsfoot Oil, Castor Oil, Linseed Oil, and almost any other oil recommended for belts in place of regular treatments on the market. I cannot understand why a thing made for a specific purpose should not be best for that purpose, as is usually the case in actual test. Home-made remedies are all right in cases of emergency, but, when the best is wanted, we invariably seek the foremost manufactured product made by manufacturers who have had most experience in their respective lines. It is logical that the manufactured product should be best. I, therefore, recommend Neatsfoot Oil only in cases of emergency, and for regular service a good manufactured treatment.

COMING CONVENTIONS.

American Railway Master Mechanics' Association, Atlantic City, N.J.—June 9-11.

Railway Supply Manufacturers' Association. Convention and exhibit in conjunction with the Railway Master Mechanics and the Master Car Builders.—June 9-16.

Master Car Builders' Association, Atlantic City, N.J.—June 14-16.

Associated Advertising Clubs of the World, Chicago.—June 20 to 24.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring Meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

MOTOR TUG FOR HUDSON BAY.

THE Hudson Bay Co. are having built at the Polson Iron Works, Ltd., Toronto, a gasoline engine driven tug for service in Hudson Bay and other northern waters. The hull is specially designed to suit the particular service for which the tug will be used. It is constructed with steel framing over which is laid wooden planking. Another feature is the turtle deck made of steel plate over the forward section, while amidships above the deck is a steel plate deck-house for protection against the weather.

The principal dimensions are as follows: Length over all, 36 feet; breadth moulded, 9 ft. 6 in.; depth moulded, 4 ft., and draft, 3 ft. The propelling engine is a "Buffalo" 30 h.p. 2-cylinder gasoline motor. As the tug will frequently be used for lightering purposes, four tow barges are also being built. These barges are of steel frame construction with wooden planking laid over in a similar manner as in the tug. The barges are 48 feet long; 14 feet wide and 4 ft. 11 in. deep. They will be shipped "knocked-down," and re-erected at point of destination.

The American Locomotive Co. has placed an order with the Chapman Double Ball Bearing Co., Ltd., Toronto, for 68 elevating transfer trucks for its Richmond, Va., and Dunkirk, N. Y., shops.

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Vol. XIII. JUNE 10, 1915 No. 23

PRINCIPAL CONTENTS.

WAR ORDERS AND THE BUSINESS OUTLOOK.

ORDERS for war material are still being placed, but, in many cases, manufacturers are hesitating because of the growing scarcity of trained men. Quite a number who have been employed steadily in Canada for some years are now leaving to accept positions in the United Kingdom. The result is that responsible contractors hesitate to obligate themselves to deliver munitions in given quantities when inducements are offered their men to leave for Britain. This movement, coupled with the prospect of a very great shortage of labor during harvest, adds some uncertainty to the business outlook.

GIVING PLACE TO WAR MUNITIONS.

EACH succeeding week in the life and record of our time, gives unmistakable point to the fact that business arising from and for the successful prosecution of the war is that on which our Canadian engineering and allied enterprises must in greater degree concentrate. In making this assertion it is by no means inferred that those concerns not yet engaged in the manufacture of shells must needs be forced into it, or that their taking a hand involves even the semblance of sacrifice.

Insistent and positive assertion has, we believe, contrived and contributed to make us feel, if not believe, that our Dominion is "all right," therefore we have concluded to let Providence and the farmer both prove and maintain it so. Industrial enterprise in a multiplicity of capacity has gone into the shell business, patriotically and commercially, and soon, few, if any, of our responsible concerns will have ignored the call or passed-up the opportunity. What surprises us, however, has been the studied indifference displayed in many quarters to this matter of shell manufacture, for only now are many of our engineering and metal-working plant administrations waking up to their privilege and opportunity.

In another section of this issue, reference is made to the organization of female and student labor for munitions of war production in Great Britain. Attention is also directed to the decision to utilize a certain technical school and its student enrolment for the manufacture of shells. Isn't there some scope in Canada for some such development? In Montreal and Toronto, at least, are to be found technical schools whose capacity and equipment are quite equal to the task of producing something up to one hundred shrapnel shells per day, if only those responsible for the administration were alert to the situation.

Wouldn't it be some real worth tribute to what these institutions are designed to accomplish, and wouldn't it seal for all time their educational value, both practical and technical, to have such of our technical schools as those named, and others, inaugurate right now a shell manufacturing enterprise? The benefits derivable would be threefold—the cause would be advanced, our manufacturers would have opened up to them a new source of skilled help supply, and a keener public interest would be evinced in the work and aim of technical and industrial education.

The difficulties to be overcome in taking advantage of such an opportunity as now exists are little, if any, harder than those successfully negotiated by our manufacturing plants, large and small. Besides there would, it appears to us, be little possibility of a shortage in either youthful labor in the day time or manhood labor for a three-hour shift in the evening. There would be just sufficient novelty in the work, esprit de corps or patriotism, present to not only maintain but increase interest, and with the added incentive of fair remuneration, we believe shell manufacture would progress merrily.

Machine tool equipment for the manufacture of shells has been for some considerable time now at a premium as regards delivery, and little if any of the required type is to-day to be found idle. In spite of the advent of summer holidays and the usual school closing accompaniment, shouldn't some cognizance be taken of the stress and requirement of the day, and steps be taken to insure that all machine tools either meantime suitable or easily adaptable to the production of shells be pressed into service? The opportunity to prove the practical worth and utility of our technical and industrial schools has never been so easy of embrace. Their national standing calls for a national response, and their relation to our industrial life calls for a co-operative effort.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal	Toronto
Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.40
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 00	$12 00
Copper, crucible	14 00	14 00
Copper, unch-bled, heavy	13 50	13 50
Copper, wire, unch-bled	13 50	13 50
No. 1 machine, compos'n	12 50	12 50
No. 1 compos'n turnings	9 25	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 75	4.75
Teal lead	$3 75	$3 75
Scrap zinc	17 00	17 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 3, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	39	....	....
½ in.	68	48	....	....
¾ to 1½ in.	73	53	....	....
2 in.	73	53	69	49
2½ to 4 in.	73	53	72	52
4½, 5, 6 in.	....	....	70	51
7, 8, 10 in.	....	....	67	48
X Strong P. E.				
¼, ⅜ in.	56	39	....	....
½ in.	63	46	....	....
¾ to 1½ in.	67	50	....	....
2, 2½, 3 in.	68	50	....	....
2 in.	....	....	63	47
2½ to 4 in.	....	....	63	50
4½, 5, 6 in.	....	....	66	50
7, 8 in.	....	....	59	42
XX Strong P. E.				
½ to 2 in.	44	29	....	....
2½ to 4 in.	....	....	44	29
Genuine Wrot Iron.				
⅜ in.	57	33	....	....
½ in.	62	42	....	....
¾ to 1½ in.	67	47	....	....
2 in.	67	47	63	43
2½, 3 in.	67	47	66	46
3½, 4 in.	....	....	66	46
4½, 5, 6 in.	....	....	63	44
7, 8 in.	....	....	60	41

Wrought Nipples.

4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%

Standard Couplings.

4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto
Lake copper, carload	$21 00	$21 00
Electrolytic copper	20 50	20 75
Castings, copper	20 25	20 50
Tin	45 00	40 00
Spelter	30 00	30 00
Lead	7 25	6 50
Antimony	35 00	40 00
Aluminum	23 50	24 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 10 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	7.62
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.82
Linseed oil, boiled, single bbls.	0.85
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.15½
Transmission rope, Manila	0.18½
Drilling cables, Manila	0.16½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40 to 45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$ 2 90	$2 90
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	4 95	4 95
Queen's Head, 28 B.W.G.	5 25	5 25
Fleur-de-Lis, 28 B.W.G.	5 05	5 05
Gorbal's Best, No. 28	5 25	5 25
Viking metal, No. 28	4 75	4 75
Colborne Crown, No. 28	5 05	5 05

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07½
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., June 7, 1915.—Market conditions have been extremely quiet throughout the last week in practically all lines except that of metals. The steel interests have been going after business strenuously, and the eloquent appeal made by Britain for more shells has come home. Manufacturers connected with this work are putting forth every effort to increase their production. Spelter and lead have demanded a great deal of attention in the metals section, especially the former.

The Steel Market.

Greater activity than ever is being shown by our steel companies to get business, and the demand for shells is being met whole-heartedly by them in the matter of the manufacture of the necessary steel. Some foreign business is meantime being secured, and there is not the slightest doubt that this will be substantially increased in the future.

Pig Iron.

The pig iron market keeps flat, there being but few sales reported and no price changes.

Machine Tools.

The demand for a greater production of shells maintains in the machine tool market the already unprecedented situation. Manufacturers of tools are sparing no efforts to get increased produc-

tion from their plants. Deliveries are, however, in many cases problematical. Trade in jigs and fixtures suitable for tooling up standard machines so that they can be pressed into this urgent work is very brisk. There is really no solution to the abnormal situation other than to let time work its own remedies. Meanwhile the ingenuity of our mechanical men is being tested to the limit, and we are glad to say they have not been found wanting.

Metals.

Copper has been very quiet during the week, not many sales having been reported. The price keeps quite firm, however.

Tin has started to go up in price again, and is now 45c. This is due to the short supply in America and the uncertainty of future deliveries.

Spelter is the centre of interest. It has gone up to 30c a pound, which is more or less phenomenal. It is hinted in some quarters that this price has not been established by legitimate supply and demand regulations, and that the market is being manipulated.

Lead has soared again to 7¼c, war demands, it is believed, being behind the rise.

Antimony, though scarce, has not increased in price.

Aluminum has been quiet during the week.

Toronto, Ont., June 8.—There is little change to note in the general situation, although there are indications of a revival in trade. The opinion is held by many that the depression has already reached its lowest point, and that a gradual improvement in conditions is taking place. The large volume of orders for war materials and supplies has been, and will continue to be, of great assistance towards this end. There is a greater degree of confidence in business circles on account of the encouraging crop prospects, although the financial situation has not as yet become much easier. In the engineering trade there is considerable activity in the shell business and the output is increasing rapidly.

There are a number of price changes to note this week, the principal being in galvanized sheets and pipe, due in both cases to the extraordinary high price of spelter. In the metal market, lead and spelter are higher, while aluminum has declined. The scrap metal market is stronger. Copper, brass, lead and zinc have all advanced. Quotations on iron and steel bars are firm, but unchanged.

Steel Market.

Normal business continues dull, but the requirement for shells is making greater demands than ever on the output of Canadian mills. So great is this demand that a number of inquiries for rounds have been sent to American mills for delivery in Canada. The Steel Company of Canada is devoting its bar mills exclusively to rolling rounds for shells, and other mills are also increasing production to meet the demands for shell bars and forgings. The Algoma Steel Co. rail mills are fully employed, and it is announced that the Dominion Steel Corporation is operating up to 90 per cent. of their capacity, the greater part of the business being for export. The Nova Scotia Steel Co. is also extremely busy on shell business.

Conditions in the galvanized sheet trade are serious in consequence of the shortage and high price of spelter. As was anticipated, another advance has been registered, and sheets are now 25c per cwt. higher. Although present figures are abnormal, there are no indications of any relief for the present as far as the spelter market is concerned. Efforts, however, are being made to find a substitute for spelter for coating sheets, which, if successful, will tend to bring about more normal conditions. The spelter situation is also responsible for higher prices for galvanized pipe, representing an advance of about 12 per cent. The new basing discounts are now in effect, and are given in the selected market quotations, as are also prices of galvanized sheets.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Pig Iron.

The market is featureless and demand continues light. Foundries are operating at considerably reduced capacity.

Scrap Metals.

The scrap metal market is moving in sympathy with pig metals, and prices of all copper, brass, lead and zinc scrap have advanced on good demand. Scrap copper is 1c per pound higher; No. 1 machine composition, 2c; composition turnings, ½c; brass scrap, 2c; lead, ½c; while scrap zinc has reached the abnormal figure of 17c per pound. Iron and steel scrap are unchanged and the market dull. Prices of scrap will be found in the selected market quotations.

Machine Tools.

Considerable activity is reported in the machine tool trade, although it is practically impossible to get anything like prompt delivery on new tools. This situation has caused a good demand for second-hand drills and engine lathes tooled up for making shells. Turret lathes and automatics are also in good demand, but difficulty is being experienced in getting tools when they are wanted. An increasing number of inquiries are being sent out for machine tools for high explosive shells, and it is expected that large orders for this type of shell will be distributed. Ordinary business is quiet, the activity being entirely confined to shell equipments.

Supplies.

Business continues good in consequence of the shell business. A brisk demand is reported for chucks, tool steel, belting, waste, etc. Prices are firm, but unchanged.

Metals.

The general situation in the metal market is unchanged. The demand for metals for munitions is steadily on the increase, and ordinary business is showing some improvement. The spelter situation is getting worse, this metal being practically unobtainable. Copper and lead are very strong, the latter having advanced; but tin, although firmer, is unchanged. Antimony is firm, but unchanged, and aluminum is weaker.

Tin.—The London market has advanced, but New York is firm and active. The tin situation is improving, and there is every indication of higher prices. Locally quotations are firm, but unchanged, at 40c per pound.

Copper.—The copper position is strong, and the market has an upward tendency. Consumption continues heavy, and is expected to increase as the demand for munitions become greater. Prices will no doubt go higher. Local quotations are firm, but unchanged at 21c per pound.

Spelter.—The situation is showing no signs of improvement. There is not much business, as the limited supply will not permit of any great activity. Locally this metal is practically unobtainable, and quotations are purely nominal. A 5c advance is recorded, the quotation now being 30c per pound.

Lead.—Lead has advanced another $2 per ton in New York, and the market is very strong and active. Good business is reported at the advancing prices and the activity has been greater than at any time during the past eight weeks. Locally, lead has advanced 1c, and is quoted at 6¾c per pound.

Antimony.—The market is firmer and more active on account of good buying, there being a growing demand for anti-

mony for munitions, and all available supplies are being reserved for this purpose. There is a shortage of this metal in the local market, and the indications point to higher figures. Local quotations are nominal at 40c per pound.

Aluminum.—The market is easier and prices have declined 2c, quotations being nominal at 24c per pound.

STEEL WORKS AT NEWCASTLE. N. S. W.

OF more than passing interest to the administrations of Canadian steel products plants is the following statement from the columns of the "Weekly Bulletin," Department of Trade and Commerce, Ottawa, relative to the establishment of a steel works of considerable magnitude at Newcastle, New South Wales, Australia:

After an expenditure of about $5,000,000, the company recently commenced operations, the blast furnace being now at work and the rest of the plant is rapidly approaching completion. Contracts have already been taken for the supply of large quantities of steel rails for the Transcontinental Railway and for the various State Railway Systems throughout the Commonwealth. The company has started operations at a singularly opportune time when oversea competition is minimized by the excessive freight rates now ruling. In no branch of production is it more imperative that a country should be independent of outside supplies than in iron and steel, and in the matter of large contracts for the railways and other public utilities, the company is bound to receive a preference in accordance with the established precedent of the country. When the works are completed, the plant will, in addition to steel rails, produce structural steel, angle iron bars, sheets, fencing wire and allied goods.

In South Australia, the company owns a most valuable mountain of iron stone of exceptional quality which is conveyed by steamer, some 1,100 miles, to the extensive plant erected beside the finest coal mines in the Southern Hemisphere.

CANADA'S DEBT INCREASES.

THE financial statement recently issued shows that the Dominion's net debt at the beginning of June was $432,317,630.55, as against $313,558,250.15 at the corresponding period last year; an increase of $118,759,380.40 during the year. Included in this total is war expenditures loaned by Great Britain. In the two months of the fiscal year there has been an increase of $24,195,415.74 in the net debt because of this.

On May 31st outstanding temporary loans totalled $87,733,333, as against $8,273,333. Long term bonds will not be issued against these loans at the close of the war.

Revenue for the first two months of the fiscal year was $21,759,296.18 as against $21,572,161.41 for the corresponding month.

Consolidated expenditure for general expenses amounted to $5,780,212 as compared with $5,504,555 for the same period of 1914; an increase of over $200,000. Capital expenditure for works of a permanent character was $2,371,205 compared with $1,838,750, an increase of half a million.

The total increase is therefore about $700,000. In addition to war outlays there are heavy expenditures on public works, including railways and canals.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

FEDERAL REVENUE IS BACK TO NORMAL.

THE month of May is the first month in which full returns of the Canadian war taxation measures are available. The Dominion's total revenue for the month from Customs, excise and war tax was $9,102,565.16. In May last year the revenue totalled $9,107,165.42.

Analysis of the May returns shows customs, $7,012,082.43; excise, $1,782,518.62, compared with $7,430,264.64 and $1,676,900.78, respectively, in May, 1914.

For the first two months of the current fiscal year the total revenue is $21,759,296.18, as against $21,572,161.41 in the corresponding period last year. In these two months, special taxation was derived as follows: Banks, $248,500.78; loan and trust companies, $54,786.90; insurance companies, $76,412.62, and inland revenue war tax, $88,016.27. Railway tax returns are not due until July 15.

MONTREAL CUSTOMS RECEIPTS.

FOR the month of May, 1915, the Customs receipts at the Montreal Custom House came within $157,173.02 of equaling the receipts for the same month in 1914. If it had not been for the scarcity of tonnage, which has made it difficult for Canadian merchants to get goods from Great Britain, the receipts for last month would probably have exceeded those of May last year. If the same number of regular liners had been coming to the port as there were last year, it is estimated that they would have been able to carry considerable cargoes, owing to stocks being low in the country.

The total receipts for May were $1,854,980.45, as against $2,012,153.47 in May of last year. For April, the receipts were $1,580,738.38, as against $1,571,255.19. Up to the end of May the receipts in 1915 have been $8,342,419.23, made up as follows:—January, $1,541,064.56; February, $1,680,107.41; March, $1,685,528.43; April, $1,580,738.38; and May, $1,854,980.45.

GOVERNMENT WORKS WILL BE CONTINUED.

IN connection with the request of the delegation of Canadian Mayors that measures be taken by the Dominion Government to relieve unemployment, it is announced that the Government will continue the construction of all public works under contract in Canada. The total expenditure of the Dominion for the year, apart from the war, will reach $200,000,000, while the war expenditure will make $100,000,000 additional. The Federal Government is, therefore, raising about $1,000,000 per day, exclusive of Sundays, to maintain its existing programme and carry on the war.

In addition to outlays in other departments, the Government programme for the current year includes expenditure upon public works of over $25,000,000, on railways and canals of $27,000,000, on capital account alone and on works of Harbor Commissioners of over $3,500,000.

Since the outbreak of the war, the Dominion has used every effort not only to prosecute the war, but to minimize unemployment in Canada by maintaining its programme of public works, including the I.C.R. terminals at Halifax, Welland Canals, Quebec Bridge, N.T.R. and Hudson Bay Railroads, terminal elevators and harbors at Halifax, St. John, Quebec, Montreal, Toronto, Hamilton, Port Arthur and Fort William, Vancouver and Victoria.

TONNAGE DECREASES AT CANADIAN PORTS.

THE scarcity of ocean tonnage continues to constitute the chief obstacle to the carrying on of the external commerce of the Dominion. A statement has been prepared here officially showing to what extent the tonnage has declined chiefly as a result of the withdrawal of so many ships for Admiralty purposes, as well as from other causes arising from the war. This statement deals with the condition on both oceans and applies to all the principal ocean ports of the Dominion. The figures are for April, and in each case the register tonnage is given. For Victoria, B.C., the figures are 152,373, as compared with 196,987; Vancouver 140,600, against 212,920; Montreal 2,734, against 35,958; Quebec nil, against 40,232; St. John 131,853, against 108,983; and Halifax 125,000, against 223,052. It will be seen that in every port with the single exception of St. John, there is a substantial decrease in the tonnage for the month of April. The St. Lawrence figures are partly governed by navigation conditions.

COAL PRODUCTION IN CANADA.

SALES, shipments, colliery and other mine consumption and coking productions of coal in Canada for 1914 amounted to 13,594,984 short tons, valued at $33,433,108, compared with 15,012,178 tons, valued at $37,334,940 in 1913. This was a decrease of 1,417,194 tons, or 9.4 per cent. in quantity and of $3,901,832, or 10.4 per cent. in value.

Arbitrary values are assigned to coals of Nova Scotia and of British Columbia. These are rated as $2.50 per long ton for Nova Scotia and $3.50 per long ton for British Columbia. In the other provinces prices are those returned by the operators. Distribution of production is as follows:

	Tons.	Decreases.	Value.
N. S.	7,338,790	641,283	$16,381,228
Alta.	3,667,816	346,939	9,367,602
B. C.	2,238,339	476,081	6,994,810
Sask.	232,541	x19,644	375,438
N.B.	104,055	x33,744	260,270
Yukon	13,433	6,279	53,760

x—Increase.

Ottawa, Ont.—Announcement of the suspension of the big works at Courtenay Bay is confirmed by the Public Works Department, the contract of the Norton Griffiths Co. having been cancelled. It is stated that the works, entailing an expenditure of about $7,000,000, were to have been completed in two years, but at the rate of progress it appears likely to take 10 years. The company was notified to speed up, and it failed to do so. The works will not be abandoned, but it has not been decided whether the Government will complete it or call new tenders.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Milton, Ont.—P. L. Robertson Co.'s factory is being equipped for making shells.

Sarnia, Ont.—The Imperial Oil Co. is building high pressure stills for the making of gasoline.

Calgary, Alta.—The Buckeye Machine Co. is installing the necessary machinery for making shells.

St. Thomas, Ont.—The St. Thomas Steel Vault Co. factory will be equipped for making shells.

Woodstock, Ont.—The George H. King Co. will install the necessary equipment for making shell parts.

Milton, Ont.—The P. L. Robertson Co. is installing machinery to make shells for the British Government.

Windsor, Ont.—The Swedish Crucible Steel Co. are making extensions to their plant, and will install a new cupola.

Hull, Que.—The new equipment at the Hull waterworks will include a turbine pump of 1,200 horse-power and an electric generator of 600 kilowatts.

Quebec, Que.—The Eastern Canada Steel Co. are equipping a plant at St. Malo for making shells. An order for 70,000 has been received.

Vancouver, B.C.—The large order for shells to be distributed by the Vancouver Engineering Works will be for lyddite and not shrapnel shells, as originally announced.

Lindsay, Ont.—The F. R. Wilford Co. have made arrangements to take over the Sylvester factory and will install the necessary machinery for making 18-pounder high explosive shells.

Demand for Shell Steel.—It is reported from Cleveland, Ohio, that inquiries are coming in from the Canadian market for prices and deliveries on large rounds to be used for the making of shrapnel for the French Government. Canadian mills are unable to meet the demands of the British and the French Governments.

The Algoma Steel Co., Sault Ste. Marie, Ont., which has already secured important rail orders from American railroads, in competition with the big steel mills on the other side of the line, is reported to be after further business of this character and to have bid for the big order to be placed by the Pennsylvania System.

Toronto, Ont.—The erection of a complete modern plant for the reduction of by-products of their mines is contemplated by the Crow's Nest Pass Coal Co. Elias Rogers, the president, has been in England securing plans and specifications from the Simon-Carves Co., Ltd., of Manchester, the great Anglo-French builders of by-product coke ovens, for an up-to-date plant for the Crow's Nest property. The by-products which will be turned out will be sulphate of ammonia, ammonical liquor, benzol and tar.

EQUIPMENT FOR AUSTRALIAN RAILWAYS.

Tender forms, specifications, etc., have been forwarded by D. H. Ross, Trade Commissioner at Melbourne, for equipment required by the Victorian Railway. These tender forms are open to the inspection of interested Canadian manufacturers at the Department of Trade and Commerce, Ottawa (refer File No. 1435), and particulars of the requirements, together with the date on which the tenders close at Melbourne, are briefly outlined thus:

No. 28,764—July 28.—One vertical milling and profiling machine and accessories.

No. 28,765.—July 28.—One plain milling machine and accessories.

No. 28,869.—July 28.—One universal testing machine and accessories.

The departure of mails in time for the above tenders is as follows:

From San Francisco—June 23; due Melbourne, July 21.

From San Francisco—July 6; due Melbourne, July 27.

Electrical

Dorchester, Ont.—A hydro-electric money by-law passed on May 20, by a large majority.

Edmonton, Alta.—The Provincial Government of Alberta will install a 125-k.w., direct-current generator at the new penitentiary, Ft. Saskatchewan.

St. Thomas, Ont.—Extensions to the ornamental lighting system are under consideration.

Sarnia, Ont.—The City Council are in favor of improvements to the street lighting system.

Kingston, Ont.—It is proposed to install new electric lights on Barriefield Road at a cost of $721.

Hamilton, Ont.—The Hydro Board is considering the matter of raising $240,000 by debentures to carry on new construction work.

Municipal

Huntsville, Ont.—The by-law to authorize waterworks extensions was carried on May 31.

Victoria, B.C.—It is proposed to install a number of sanitary drinking fountains in the down-town sections of the city.

Salmon Arm, B.C.—The council contemplates an expenditure of $60,000 on waterworks and street lighting extensions.

Hull, Que.—Extensions to the water distribution system to cost $100,000 are contemplated. The by-law has been passed.

Newmarket, Ont.—The town will sell the steam power plant consisting of two Corliss engines and generators, switchboard, etc.

Toronto, Ont.—Improvements to the Morley avenue sewage disposal plant are contemplated. An "Imhoff" tank may be installed.

Paris, Ont.—The ratepayers will vote on a by-law on June 7 to guarantee a bond issue of $10,000 to C. E. Wheelet & Son, needle manufacturers.

Hespeler, Ont.—A well is being drilled for increasing the water supply. Tenders will be called shortly for the construction of a reservoir, a standpipe and hydrants. Kitchen & Johnstone are the engineers.

Petrolia, Ont.—At a meeting of the council, the Fire, Water and Light Committee gave notice that they would introduce a by-law for raising $35,000 for constructing a new plant for hydro power or for buying and reconstruction of the present plant.

Ottawa, Ont.—The tender of Heap & Partners, Ltd., Montreal, for booster pumps has been provisionally accepted by the city. The company's tender was the lowest, and amounted to $5,100.

Welland, Ont.—A test section of the gigantic water pipe which is to bring fresh water from Lake Erie to Welland, Thorold, Merriton and St Catharines, is soon to be constructed. This section will be about 200 feet long and 5 feet in diameter and will form part of the main pipe.

Toronto, Ont.—Should the several municipalities interested endorse the scheme prepared by Chief Engineer McLean for the construction of an improved highway between Toronto and Oshawa, a commission will be created in the near future to carry out the project. The cost of the work is estimated at $237,000, plus $127,905 for grading, cutting down inclines, drainage, culverts and the construction of new bridges.

General Industrial

Sandwich, Ont.—The Canadian Salt Co. will make an etxension to their plant to cost about $15,000.

New Westminster, B.C.—The Liverpool Canning Co. will build a salmon cannery here to cost about $10,000.

St. John, N.B.—Fire on May 27 in the shipping department of the Atlantic Sugar Refineries caused considerable damage.

Sherbrooke, Que.—The Page Printing & Binding Co. will establish a paper box factory here. A section of the Page Building will be used for the purpose.

Walkerville, Ont.—Hartwell Bros. will build a factory here for making implement handles. The Williamson Construction Co. are the contractors.

Hamilton, Ont.—Davis Bros. are erecting a modern clothing factory. The building will have an 80-ft. frontage and will be three stories high.

Toronto, Ont.—The American Fire Extinguisher Co. will erect a new factory, 50 by 100 feet, at the corner of Weston road and Westport avenue.

Toronto, Ont.—Fire totally destroyed the premises of the Canada Film Co. and the Indestructible Brick Co. at Swansea, near here, on May 31, doing damage estimated at $115,000.

Preston, Ont. — The Hurlbut Shoe Co. propose to erect a factory here to cost $25,000, including machinery. The company are asking for a loan of $25,000, repayable in 15 years. A by-law will be voted on.

Owen Sound, Ont.—The Northern Bolt & Screw Co. has received an order from British wholesalers for nails and wire, which will keep them running day and night for a long period.

Collingwood, Ont.—The Bryan Manufacturing Co. will probably rebuild their factory on modern lines at an estimated cost of $75,000. The town will be asked to loan $30,000, repayable in 20 years.

London, Ont.—Fire originating in some cotton waste on June 6 gutted the factory of the Thomson Knitting Co., 77 Dundas street, doing damage to the extent of $50,000. The loss is fully covered by insurance.

London, Ont. — The Wright Lithographing Co. of this city, have purchased the plant of the Laidlaw Lithographing Co., of Hamilton, which they are moving here. The building of the Wright Co. will be enlarged.

Perth, Ont. — John E. Playfair's cheese box factory at Fallbrooke was destroyed by fire on May 27 with all the contents excepting the engine, boiler and veneering machine. The loss on the building is $1,500, and on the shafting, belting and machinery $2,000, with no insurance.

Fort William, Ont. — Construction work on the three elevator additions in the city, the Ogilvie flour mill elevator annex, the addition to the Western Terminal elevator and the annex to the Dwyer elevator on Island Number Two, is progressing rapidly, and it is expected that all three additions will be completed by the fall.

Chatham, Ont.—The Dominion Sugar Co. of Wallaceburg will erect a factory here, but before they do so, they demand a guarantee of railway connection with the G. T. R., for which it is necessary to cross the C. P. R. Arrangements are under way, and a by-law granting a free site will likely be offered to the ratepayers soon.

Tenders

Hespeler, Ont.—Tenders are being called for pumping machinery and a steel water tank. Full information may be obtained from Bowman & Connor, engineers, Berlin, Ont.

Ottawa, Ont.—Tenders will be received up to July 1, 1915, for the manufacture, supply and erection of a 30-ton steam wharf crane, of the derricking jib type, for Halifax, N.S., dockyard. The specifications and conditions of contract may be seen at the office of the consulting naval engineer, Ottawa.

Stratford, Ont.—Tenders for a 500,000 Imperial gallon elevated water tower will be received until Friday, June 25, 1915. Copies of the specifications and form of tender, can be obtained from F. A. Gaby, Chief Engineer, Hydro-Electric Power Commission of Ontario.

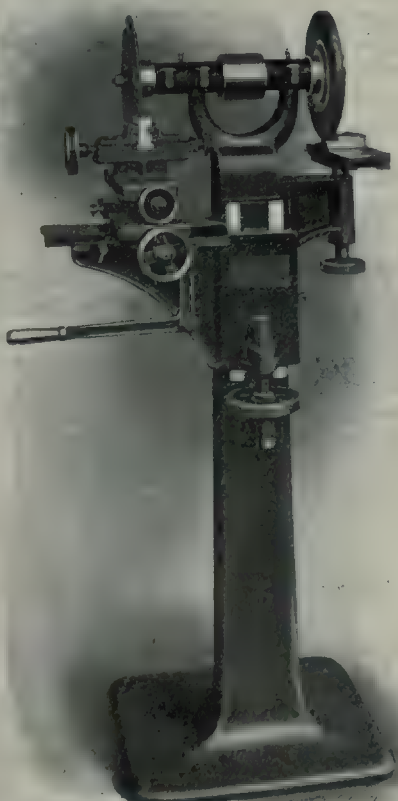
Quebec, Que.—Tenders for storage dam at La Loutre on the St. Maurice River, will be received at the office of the Quebec Streams Commission, Room 264, Parliament Building, Quebec, until Tuesday, June 15, 1915. Plans and specifications can be seen at the said office, or at the Quebec Streams Commission's office, Room 803, McGill Building, Montreal.

Montreal, Que.—Tenders for constructing the exterior electrical system for the filtration plant of the city of Montreal, P.Q., will be received at the office of the Board of Commissioners at Montreal, P.Q., until June 15, 1915. The plans and specifications are on file in the office of the chief engineer of Public Works of Montreal, from whom copies may be obtained. A deposit of $10 will be required.

Fredericton, N.B. — The Provincial Public Works Department has issued a new call for tenders for construction of the substructure of the proposed new bridge over the Petitcodiac River at Moncton. Tenders, which are to close on June 16, are invited under the same plans and specifications as before, and contractors will submit figures for both open dredging and pneumatic caisson methods of performing work.

Hamilton, Ont.—Tenders will be received by Chairman of Board of Control, up to Wednesday, June 16, 1915, for the following: One 10-ton travelling crane, with all appurtenances for the hand operation of same, complete with block and tackle and the necessary transverse and longitudinal girders and supports. Specifications covering the above may be obtained on application to the City Engineer's office, city Hall, Hamilton.

Toronto, Ont.—Tenders will be received up to Tuesday, June 15, 1915, as follows: (a)—For the concrete masonry substructure and concrete floor of the Strachan Avenue Bridge over the C. P. R. tracks; (b)—For the supply and erection of steel superstructure of the above-mentioned bridge. Tenders must be addressed to the Chairman Board of Control, City Hall. Specifications and forms of tender may be obtained upon application at Room No. 311, Department of Works, City Hall.



Contracts Awarded

Toronto, Ont.—The Board of Control has awarded the contract for a sludge pump to the John Inglis Co., Toronto, at $6,490.

Toronto, Ont.—The contract for the piling on the Don incinerator has been awarded to John Russell, and it will cost about $7,000.

Winnipeg, Man.—The Board of Control have purchased a five-million-gallon pump from the American Well Works, Ltd., Aurora, Ill.

Stratford, Ont.—Brennan & Hollingworth, of Hamilton, Ont., have been awarded the contract for concrete piping for the new $72,000 sewer.

Quebec, Que.—The contract for the erection of the new C. P. R. Union Station at the Palais has been awarded to the Downing & Cook Co. Work will begin at once.

Toronto, Ont.—The Provincial Hydro Commission has awarded the contract for the plumbing and electrical work in the new University avenue building to Keith & Co.

Hamilton, Ont.—The Board of Control have awarded a contract for an electric motor to the Canadian Westinghouse Co., Ltd., at $3,325, and for a pump to Canadian Allis-Chalmers, Ltd., at $1,365.

Moose Jaw, Sask.—The Roberts Filter Mfg. Co., Darby, Pa., has been awarded the contract for two filters, with a capacity of 25,000 gallons each per hour, to be installed at Snowdy Springs. The price is $4,633.15.

Vancouver, B.C.—It is announced that the firm of Marsh, Hutton and Powers, contractors, of Port Arthur, Ont., have secured a $400,000 contract in British Columbia. The work is for the main channel jetty on the Fraser river at Richmond, and will employ a large force of men.

St. John's, Nfld. — The contract for the erection of Cochrane Methodist Church has been let to the Downing-Cook Co., of Montreal, their tender —$80,000—being the lowest of nine received. The contractors agree to have the buildings ready for occupancy within eight months from June 1. The Downing-Cook Co. will do the work at actual cost price, plus commission.

Building Notes

Quebec, Que.—An extension to the Foundling Hospital here, to cost $50,000, will be built. Edmond Belanger is the contractor.

Toronto, Ont.—J. F. Hartz has taken out a permit for a warehouse and showroom at 24-26 Hayter street, to cost $35,000.

St. John's, Nfld.— The contract for erecting the Commercial Cable Co's. new office has been awarded to W. J. Ellis. Estimated cost, $80,000.

Regina, Sask.—The contract figure for the new one-storey building which is being erected by T. Bernard for Nay & James on Hamilton street is $8,500.

Toronto, Ont.—Ground has been broken for the new School Administration Building on College street, beside the old Technical School. H. N. Dancy & Sons are the masonry contractors.

Guelph, Ont.—It is proposed to build a new residence building at the Ontario Agricultural College, and also complete the Physics building. $80,000 has been appropriated for the work this year.

Toronto, Ont.—The Drug Trading Co. has received a building permit from the City Architect's Department for the erection of a four-storey brick and mill construction warehouse costing $20,000, at 10 Ontario street.

London, Ont.—At a meeting of the Board of Education held recently, the contract for the new North End School was awarded to John Hayman & Sons, at $57,100, and for the West London School to L. H. Martyn, at $5,100.

Tavistock, Ont.—The ratepayers on May 27 carried a by-law empowering the Council to take over the public library and convert it into a free library, with a view to obtaining a grant of $7,500 from the Carnegie Library Corporation for a new building.

Toronto, Ont.—Tenders for the Jesse Ketchum school, to the total amount of $140,000, will be submitted by the property committee to the Board of Education for approval. The property committee will also ask the board for authority to add a new wing to the Riverdale Public School. The wing will contain four class rooms.

Trade Gossip

The Gananoque Electric Light Co. has had its powers extended and capital increased from $40,000 to $100,000.

St. John's, Nfld.—Peter Mars has gone north to look after the shipping to England of several cargoes of pit props.

The Canadian Ice Machine Co., Toronto, Ont., has sold a 100-ton "York" vertical motor-driven ammonia compressor plant to the J. Hungerford Smith Co., Toronto.

The Chapman Double Ball Bearing Co., Toronto, have received an order for line-shaft ball bearings from the Bethlehem Steel Co., South Bethlehem, Pa.

John Watson & Son, of Montreal, Ltd., have been awarded the contract for the ornamental iron at the Ross Pavilion, Royal Victoria Hospital, Montreal. This is, we understand, the largest contract for ornamental iron that has been let this year.

The Canadian Ice Machine Co., Toronto, has installed a 100-ton "York" horizontal motor-driven compressor at the Chatham Packing Co. plant, Chatham, Ont., and a 20-ton steam-driven vertical machine at the Robert Simpson Co. plant, Toronto.

Ottawa, Ont.—A plant for the manufacture of large quantities of trinitrotoluol, one of the highest explosives known to modern science, has been erected in Canada and is now in operation. It is reported that plants to make large quantities of guncotton will also be in operation shortly.

St. John's, Nfld.—It is reported that, on account of so many of its inhabitants having joined the colors and due to the depression in trade, which has been so manifest of late years, the island of St. Pierre, a French colony off the west coast of Newfoundland, will after war, be annexed to the latter territory.

Shell Order Speculation. — Certain firms which accepted shell orders as a speculation and afterwards sublet their whole contracts to other firms, have, we understand, now been brought to book and have been notified that their orders would be cancelled if they were sought to be filled under such conditions. The Shell Committee does not intend to allow second and third profits where it can avoid them.

Iroquois Falls, Ont.—It is fully expected that before the end of June the Abitibi Pulp and Paper Co. will commence operations. The first unit will give the company an approximate output of 60 tons daily and this is to be followed by the installation of three additional units later in the year. The entire paper mill will be running, it is expected, before the end of 1915, when an output of over 200 tons daily will be realized.

Ottawa, Ont. — Alex. Johnston, Deputy Minister, and Col. Anderson, chief engineer of the Department of Marine and Fisheries, have returned from a trip of inspection to the Pacific Coast. They say that while trade is quiet at present, the development of ports and the construction of railways now in progress in British Columbia is preparing the way for larger business which is expected to develop after the war. The

marine officials state that the G. T. P. dry dock at Prince Rupert, the largest north of San Francisco, which is about completed, will be of material asistance in the development of the Pacific Coast trade.

Russian Engineers Coming.—Six eminent Russian engineers, commissioned by their Government to come to the United States and Canada on a trip of inspection of war-time supplies bought for Russia in America, reached New York on June 4, aboard the steamer Bergensfjord from Scandinavian ports. The party consisted of Maximilian Groten, Michael Bronikovsky, Michael Jurin, Nicolai Kemmer, Victor Kofhkin and Arcady Martynoff. They will remain in New York, it is said, for about two weeks. After their work in the United States will have been completed, the party will assume similar labors in Canada. They expect to remain in North America about six months.

St. John's, Nfld.—The following items are from the financial report of Finance Minister M. P. Cashin of Newfoundland delivered before the House of Assembly a few days ago, for the fiscal year ending June 30, 1915:—Estimated expenditure, $4,014,970; estimated revenue, $3,300,578; deficit, $714,392. To help offset this deficit a reserve of $198,000, will be brought forward, leaving a net debt of, $516,000. In order to make both ends meet at the end of the fiscal year 1915-16, the Financial Minister proposes to impose a 10 per cent. duty on all articles now on the free list, with a few exceptions, including an export duty of $1.00 per thousand on pit props going out of the country. The total indebtedness of the colony, including a loan of $1,000,000 from the Imperial Government since the beginning of the war, is $32,000,000.

Railways—Bridges

Municipality of Swan River, Man.—A by-law will be voted on to raise $20,000 for building a number of steel bridges.

Quebec, Que.—The C. P. R. will proceed with the construction of the new station to cost $1,000,000. The general contract will be awarded at once, but the tenders for the power-house will not be called until later in the year.

Toronto, Ont.—Work on the new station at North Toronto, to be jointly occupied by the C. N. and C. P. railways, has commenced. It is said that the new building will cost about $2,000,000. P. Lyall & Sons of Montreal are the contractors.

Ottawa, Ont.—It is announced that arrangements are now being made for securing a large amount of rolling stock and other equipment for the National Transcontinental Railway. Hon. Frank Cochrane has asked Hon. W. T. White, Minister of Finance, for a very considerable appropriation.

Vancouver, B.C.—Officials of the Pacific & Great Eastern Railway announce that, through the Provincial and Dominion Governments, they have secured about three million dollars, with which to complete the line as far north as the Hundred-mile House in Cariboo, a distance of 223 miles from Vancouver.

Brantford, Ont.—The Brantford Street Railway Commissioners have decided to accede to the requests of the Lake Erie and Northern Railway, asking virtually for their right-of-way from Paris to Galt, provided they are fairly recompensed for the improvements they have effected upon the road since they came into possession.

Berlin, Ont.—Ex-Mayor W. D. Euler, district vice-president of the Ontario Hydro-Radial Union, has sent out resolutions for endorsation by the municipal councils of the Cities of Berlin and Guelph, and the Townships of Waterloo and Guelph, requesting that the Hydro-Electric Commission make a survey for a proposed Hydro-Radial railway between Berlin and Guelph, via Bridgeport, Bloomingdale and New Germany.

Montreal, Que.—The city's estimate of the total cost of elevating the G. T. R. tracks within the city limits is $5,057,745 as compared with the company's estimate of $8,211,000, a reduction of $3,153,255. This information is contained in a report prepared by G. R. MacLeod, engineer of railways, in the civic public works department, and submitted to the Board of Control recently.

Personal

Alexander Friddell, of Montreal, has agreed to accept the duty of financial director of the Canadian shell committee.

Huntley R. Drummond and James Carruthers, both well-known residents of Montreal, Que., have each offered $100,000 for the purchase of machine guns.

Pte. Walter E. Woodhouse of the Grenadier Guards, Montreal, and a part-

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

ner of Archibald & Brotherhood, dealers in engineers' supplies in that city, is reported wounded.

J. A. Cunningham of the B. C. Refining Co., Vancouver, has been elected president of the British Columbia Manufacturers' Association to succeed the late Mr. K. J. Morrison, lost on the Lusitania.

Alex. Milligan, who for many years sailed several of the big steel grain freighters for the Montreal Transportation Co., died at St. Catharines, Ont., on May 29, aged 57. He retired about six year ago.

William James Campbell, president of the Campbell Steel & Ironworks Ltd., of Ottawa, Ont., died on June 2. Mr. Campbell was born at Chatham, England, 65 years ago, but had lived in Ottawa since 1867.

Capt. Charles E. McGee, until recently assistant manager of the Moose Jaw Electric Railway, has been killed in action. Capt. McGee was in command of a company of the 60th Rifles and also served in South Africa.

William H. Ewald, who for the past five years was superintendent of the Hespeler foundry of the Canadian Machinery Corporation, has been appointed manager of the Canadian Buffalo Sled Works, Mr. Melville, the former manager, having resigned.

Ottawa, Ont.—It is reported here that Sir Thomas Shaughnessy's visit to England is being made at the urgent request of Lord Kitchener, who is anxious for him to take charge of the British War Office purchase of munitions of war in Canada and the United States.

H. G. White of the firm of Harrison & White of Vancouver, B.C., has been appointed trade commissioner by the B.C. Provincial Government under the auspices of the Vancouver and Victoria Boards of Trade. Mr. White will visit the West Indies and Central America.

Lieut.-Col. Cantley, of New Glasgow, N.S., has returned to Canada from the front. Col. Cantley while in Europe was in conference with representatives of the Russian Government and has brought back large orders for cars to be built in Canada for the Russian military service.

James Wallace, for many years chief engineer on the Princess Victoria, C.P.R. Pacific Coast steamship, was acting in the capacity of chief engineer aboard the Princess Irene when that vessel was blown up in Sheerness harbor, England, on May 27. In a cable received by Captain Troup from the British Admiralty, it was stated that Mr. Wallace had been in the accident and that the worst was feared. W. W. Rennie, according to a cable received by his father from the Admiralty, is also said to have been lost in the accident. He was formerly third engineer on the Princess Victoria.

Catalogues

Lathe Turrets made by Fay & Scott, Dexter, Me., are dealt with in a bulletin recently issued. The illustrations show some new designs of lathe turets. carriage and bed types, particularly adapted to the manufacture of shrapnel shells. A brief description is given of each style together with tables giving the principal dimensions and other particulars.

Chucks.—The Westcott Chuck Co., Oneida, N.Y., are distributing a leaflet describing the Westcott spur geared scroll cutting-off chuck, especially adapted for shrapnel shell work. The essential features of this chuck are described, and a table is included giving the principal dimensions of each size.

Gasoline Engines.—The Van Blerck Motor Co., Monroe, Mich., have sent us a copy of bulletin No. 18 together with a complete set of specifications covering the Van Blerck type of gasoline engines for commercial purposes. The bulletin is fully illustrated and features the wide field for these specialties.

Diesel Engines.—Bulletin No. 1532 deals with the Allis-Chalmers oil engines of the Diesel type. The bulletin contains a detailed description of this engine covering its construction, the cycle of operations, fuel nozzle governing and other important features. The illustrations show a number of typical specimen indicator cards, exterior and sectional views, the latter showing the general construction of the engine and arrangement of valves. Copies of the bulletin may be obtained from Canadian Allis-Chalmers, Ltd., Toronto, Ont.

Shapers.—The Gould & Eberhardt Co., Newark, N.J., have recently published an attractive 32-page catalogue devoted to their high duty shapers and attachments. The opening pages contain a full description of the "High Duty" shaper, covering the construction in detail, with illustrations showing the various parts. The following pages contain illustrations of the various sizes of these shapers, accompanied by specifications of each. The "Invincible" shaper is also fully described and illustrated. The concluding pages deal with electric motor application, a number of illustrated attachments, and a summary covering the various features of advantage incorporated in these products.

Observations on Drop Forging Production Practice*

By A. B. Tilton**

The subject matter of this paper traces in a racy and general way the present day development of the drop forging industry. Particular prominence is given to the die feature, to the variety of forging material tonnage and the fact that in recent years many lines of forgings have been standardized as regards size and style by different manufacturers.

HAMMERING or forging hot bars of metal into shape is among the oldest of the crafts. The work for hundreds of years was entirely performed by hand, and, though a marvellous degree of skill was acquired, there appears to have been but slight change in methods; indeed, most of them are still in force where hand work alone is practised.

A departure from the old ways naturally could not occur until the need demanded it and a means for satisfying it appeared. These came during the middle of the last century when the swage of the blacksmith was developed into a form of forging die and the early type of drop hammer was devised. The history of the drop forging industry lies well within this period of about seventy-five years, though by far the greatest improvements both in the machinery and practices have been made during the last twenty-five years.

The making of forging dies is almost as much of an art as it is a trade, and, except for merely elementary features, no fixed rules can be laid down for the work. In the early days of the industry there were but few mechanics, however well skilled otherwise, who could make drop forging dies successfully without a considerable period of actual practice in the work. This condition operated somewhat to retard the development for a number of years.

The Die Feature.

The making of the dies is a feature of first importance in the production of drop forgings. Each design or piece has to be given individual attention in its construction to promote ease of operation, free motion in the metal while forging, and accuracy in forms and dimensions. To permit the easy removal of the forgings from the dies a draft of seven degrees is usually allowed on the sides or vertical dimensions, although in some shapes this may be more or less than seven degrees. Ordinarily this draft is added, but where the forging is not to be finished to any particular dimension, or if the metal could be spared at that point, it is sometimes taken off. The allowance for shrinking is usually three-sixteenths of an inch to the foot, but practices vary in different shops.

For economical reasons dies are sometimes made with only a single forging impression, which reduces the first cost of the tools to a moderate extent, but the forcing of the hot metal into its final shape without any preliminary operation may sometimes result most unsatisfactorily, since it is liable to create or add to any strains that may have existed in the bar and thereby establish a centre for crystallization when the forgings are in use. By making the dies with at least two impressions, one being merely auxiliary and the other to give a final shape to the piece, the liability of any additional strains is diminished; furthermore the life of the dies is increased.

For the making of plainer pieces one set of dies is usually sufficient, but in many of the more complicated forms, such as crank shafts having three or more throws set at other than straight angles, two or more sets of dies are required, one for each separate operation. Frequently the intermediate operations may be performed in the press, which is normally an auxiliary of the drop hammer, or it may be desirable to resort to first principles and require the assistance of the blacksmith, who is yet, and probably always will be, a very important factor in the working of wrought metals.

The variety of shapes which it is possible to make by this process is almost unlimited, although some would require so many operations as to make the cost prohibitive. Where such are required, however, in large quantities this difficulty may be overcome in a measure, even though three or more operations may be required to produce them. Very thin piece, or those that are thin with heavier sections at intervals, are among the difficult shapes to produce because of the rapid cooling of the thin parts in the dies which prevents the reduction to size without reheating. Such pieces would, therefore, be more expensive than those of equal weight, but more regular in outline and of greater thickness. By far the greater number of shapes in drop forgings are, however, of such thickness and general proportion as to be quite easily handled, and those just mentioned would perhaps be more properly regarded as exceptional.

Forging Temperature.

As nearly as possible it is desirable to make steel forgings at a uniform temperature, which is about 1,800 degrees, except for tool steel, where it should be much lower at the beginning of the operation, but, as the blows or strokes of the hammer are not ordinarily sufficiently rapid to maintain the heat, the finishing stroke is made at a slightly lower temperature, and, as this temperature varies at the finish, so will the shrinkage in the cooling process of the forging also vary, the allowance for this in the dies being constant. A further variation may be expected occasionally to a smaller extent, though hardly perceptible in the matching of the dies, which, however accurately set in the hammer will vary slightly in the fall, due to the necessary play in the hammer head between the ways. These are almost negligible; however, they should be considered in the construction of jigs for the finishing work. Where uniformity of contour is essential, it is customary to obtain this by re-striking the forgings after the trimming operation in sizing dies, especially on the smaller sizes of forgings. Generally this re-striking operation is done cold, though occasionally at a low heat.

Drop Forging Tonnage.

The greatest tonnage in drop forgings is in the carbon steels, and principally those below forty points in carbon content. The proportion of tool steel forgings used in the construction of various implements and tools is very slight, but may be properly classed among the carbon steels, though high-speed steels also form a feature of the drop forging product. The growth of the automobile industry has called into use a variety of alloy steels for parts where resistance to vibration is necessary, and forgings made of nickel steel, chrome nickel, and vanadium steel now form a very large part of the product of many drop forging plants. These alloys, besides resisting vibration to a great degree, also furnish when properly heat-treated the remarkable wearing qualities so highly desirable in gears and similar parts. Copper and bronze forgings are also a considerable feature of the drop forging product, though these are restricted chiefly to electrical work and where resistance to corrosion is necessary.

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*From a paper read at the National Machine Tool Builders' Association Convention, Atlantic City, May 20-21.

**President, Drop Forging Co. of New York.

Within recent years many lines of forgings have been standardized with respect to size and style, so that they may be obtained from manufacturers without the need or expense of special forging dies to produce them. The larger part, however, of the drop forging produce consists of forgings made to customers' individual designs. In most lines of manufacture methods are somewhat uniform, but in the drop forging industry there is much difference in methods, due perhaps to the latitude within which it is possible to work and accomplish the same results.

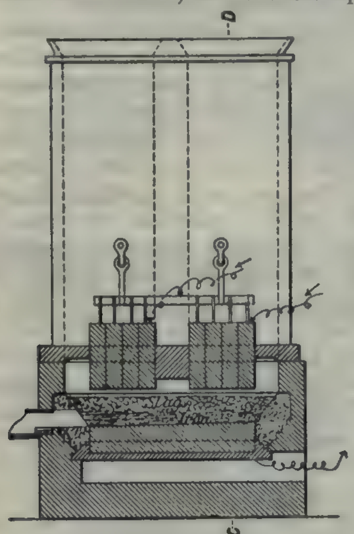


FIG. 1. SECTION AT A.B.

ELECTRIC IRON ORE SMELTING IN NORWAY.

IN Sweden the adoption of electric furnaces for the reduction of iron ore is apparently spreading, and the results obtained are encouraging and likely to lead to further developments in this direction.

In Norway matters have not progressed quite so smoothly, owing to the different conditions prevailing in the two countries. In Sweden charcoal is used as the means of reduction, but in Norway charcoal becomes too expensive and, unless coke can be used, the process cannot be worked with advantage, in spite of Norway's wealth of water-power. The first attempt with coke at the Hardanger works proved so little encouraging that the whole works eventually stopped, although the ores used were rich in iron.

At Tinfos, however, the very opposite experience has been encountered. A regular and remunerative manufacture of electric iron has now been going on for some time, and the production for the present year is estimated at 10,000 tons of electric pig. This satisfactory result is all the more noteworthy inasmuch as the ores used are rather poor so far as their percentage of iron goes, but otherwise what may be called good ore, hailing from three mines—Klodeberg, Grevinde Wedel, and Fon Anker—averaging some 45 per cent. of magnetic iron ore.

The Tinfos Electric Furnace.

The illustrations show the Tinfos electric furnace. It differs from the Swedish furnace used at Trollhättan (description of which has already appeared in our columns) by having a shaft on each side, so that the ore is led on to the two square electrodes. The upper electrodes each consist of three or four smaller electrodes that are arranged in combination.

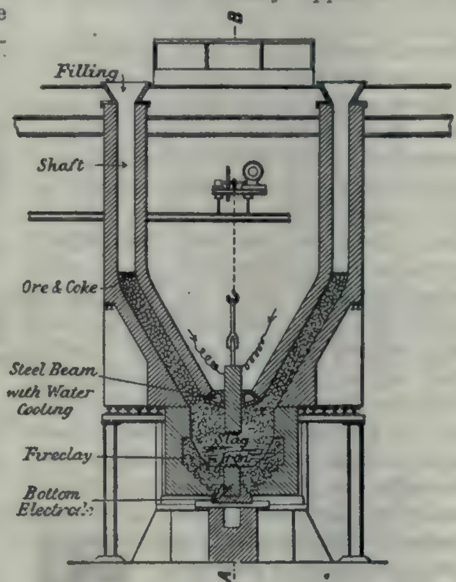


FIG. 2. SECTION AT C.D.

The electric current proceeds from the electrodes through the charge, the slag, and the liquid pig-iron, down to the bottom electrode. This furnace, consequently, differs from the Swedish furnace, not only in having a bottom electrode, but, also it has no gas circulation and requires very little water for cooling purposes. The fourth furnace differs from the three others by having three heavy round electrodes with nipples. The question of a furnace with but one shaft is by no means excluded. The charge consists of iron ore, coke, and according to circumstances, limestone, the quantity of which depends upon the nature and blending of the ore, the quality of the coke, and the quality of pig-iron wanted. Charcoal, as already mentioned, is not used.

A couple of years' patient experimenting in different directions, and not always under the most favorable conditions, have led to the production of pig of high quality, strong, and comparatively tough. Even at an early stage of the experiments it could be ascertained that the iron produced promised exceedingly well, thanks to certain good qualities in the ores used. When coke is used, the shafts of the furnace need not be very high, and, as a rule, the charge does not reach higher than a little beyond the bend in the shaft. The upper part of the shaft serves as a chimney, which produces the necessary draught in the furnace. To fill the shafts any higher with ore than shown in the illustration is not to be recommended when the ore contains zinc.

Tinfos Electric Pig Iron.

The Tinfos electric pig-iron is close, being produced electrically, without any air being blown into the furnace. This pig can thus with advantage be used for all kinds of foundry goods which require much strength, such as cylinders, presses, pumps, propellers, etc., and it can with advantage be added to ordinary cheap and less strong pig, used in the foundries with or without addition of ferro-silicon.

Tinfos pig, inasmuch as its chemical composition can be altered and regulated, can also profitably be used in Basic Martin steel-smelting, for all electric steel-smelting, or for softened castings. Among the different Tinfos pig-irons are such as contain:

Si. per cent.		Mn. per cent.	S. per cent.	P. per cent.
0.3	with	0.1 to 1.0	0.03 to 0.1	0.02 to 0.04
0.4 to 0.8		0.1 to 1.0	0.04	0.02 to 0.04
1.0 to 1.5		0.1 to 1.0	suspicion to 0.02	0.02 to 0.4
1.0 to 1.5		1.5 to 2.0	" " 0.02	0.02 to 0.04
1.5 to 2.0				
2.0 to 2.5				
		0.1	" 0.02	0.065

The cost of production, including ore, coke, limestone and electrodes, besides wages, crushing, weighing and transport of materials, mounting of electrodes, repairs, storage of iron, the laboratory and electric energy, can, according to what so far has been experienced, be kept at from $17.75 to $18.25 per ton of pig-iron (perhaps based on cheaper coke than present quotations) when all three furnaces are kept going, exclusive of management, sinking fund and taxes.

From the beginning of the present year all four furnaces have been worked regularly, one being always kept in reserve. Each furnace produces about 9 tons per day, or 27 tons for the three, making some 10,000 tons per annum. The percentage of pig-iron from the ore varies from 44 to 47 per cent. according to the quality of the latter. The current in the furnace may be as much as 1,200 k.w. to 1,400 k.w.—Engineering.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

FORM GRINDING.

By Howard W. Dunbar

THE subject of form-wheel grinding is one which, up to the present time, has been given but little thought or consideration by the user of grinding machines, therefore few realize the possibilities from the forming of the face of the grinding wheel for the purpose of producing accurate, irregular shapes. This lack of consideration and knowledge of the subject is due largely to the fact that to successfully accomplish the operation of grinding, using a formed wheel, it is necessary that a wide face wheel be used, and the operation performed by a "straight in cut," or in other words, a cut without traveling the table.

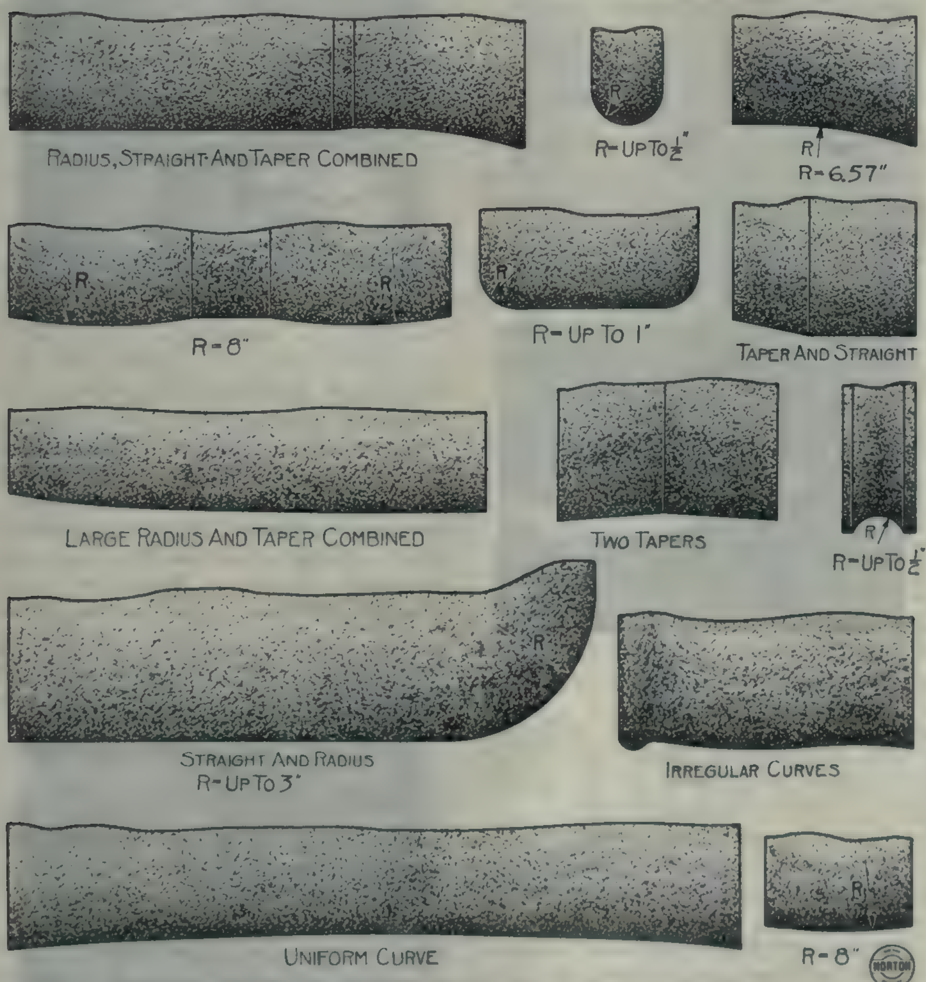


FIG. 1. SOME SAMPLES OF WHEEL FACES FOR FORM GRINDING.

Wide Face Wheels

It is within a comparatively few years that the users of grinding machines, and even some of the manufacturers of grinding machines, have accepted the theory of the use of the wide face grinding wheel as advocated and advanced by Charles H. Norton. Tradition has said that it was impossible to get accurate work properly finished and in good time by using a wide face wheel. Up until a short time ago, a wheel 1½ inches wide was considered a wide wheel. To-day, however, we have machines which carry wheels up to 12 in. face, which not only make possible the grinding of formed parts but also increase the production and broaden the field of cylinrical or straight grinding.

In the early development of the grinding machine it was only natural that the evolution should come about through the then commonly known method of producing cylindrical work—the lathe. It was reasoned that with a lathe and a traveling tool of a single point, a part could be machined by turning and a cylinder produced. Naturally, in designing the grinding machine, the designer's mind entered about the lathe, and the grinding wheel took the place of and was fashioned after the lathe tool,in that it had a very narrow face. By traveling the work and grinding with this wheel, a cylinder was produced considerably better and more accurate than that produced by the lathe. As time went on a wider and wider wheel came into use. More cutting particles were caused to do their share of the work and with faster table travel greater production was brought about, and equally good cylinders produced.

This has been carried to a point where now pieces of work up to 10 in. long are not traversed, and a wheel 10 in. wide is used to grind them. Longer work than this is traveled as always, but the same advantage can be obtained even though the work is traversed, if wide wheels are used, providing the traverse of the work is practically equal to the width of the wheel for each revolution of the work. The only limit for the width of wheels is the physical possibility of their manufacture, and the expense for machines of suitable power and durability for carrying such wide wheels.

To-day we have multiplied the cutting points that on the average wheel 4 in. wide and 24 in. diameter, 1,086,171,000 cutting points come in contact with the work each minute. Multiply this by using a wider wheel, and it, of course, becomes obvious that the greater number of cutting particles which come in contact with the work in a given time, the greater is the amount of material that can be removed.

Grinding Machine Construction

Back of these beliefs, and the principal reason for them, was the grinding machine—it was not properly constructed to carry a wide wheel. Of course, a machine using a wheel face of say 10 in. or 12 in. must be properly constructed to do the work that such a wheel is capable of. In the earlier designs of grinding machines this was not taken into consideration. The machines had been planned for narrow wheels.

Success was not assured with wide face grinding until a machine had been designed with sufficient power and rigidity and so constructed as to stand up under the strain of the work which it was called upon to do. The spindles had to be of the finest kind of material, with ample bearing surfaces and large, well-made boxes of good material.

This brings us to the point of the possibilities in using this wide face wheel with a specialty trued form for the purpose of grinding irregular shapes. It is essential in form grinding that this form be continuous and uniform, that there be no under cuts to grind, as virtually the same laws govern the possibilities, insofar as the shape of the grinding wheel is concerned as govern form milling; the grinding wheel is only a milling cutter having infinitely more teeth. In order to insure that the wheel stands up uniformly, sharp corners should be avoided, and fillets introduced in the corners whenever possible.

Form Grinding Limitations

The limitations of form grinding are governed entirely by the capacity of the

FIG. 2.

attachment used in shaping the wheel, and the observance of the peripheral speed of the wheel at the various points in the form, so that with the proper wheel this variation comes within the possibilities of the "grain and grade" furnished. Deep forms are possible but not practical, as the difference in diameter on the various points in the form produce a different action on the wheel, and naturally a wheel that is

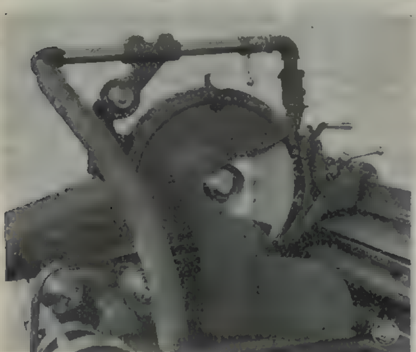


FIG. 3.

satisfactory on deep cuts is not satisfactory on shallow ones.

Of course, it is understood in grinding a form that the wheel cannot be traversed, but must be fed straight into the work. Simple forms, such as putting the fillet in the shoulder of a shaft or the neck of a roll, are accomplished with one corner of the wheel, and the straight part of the cylinder ground

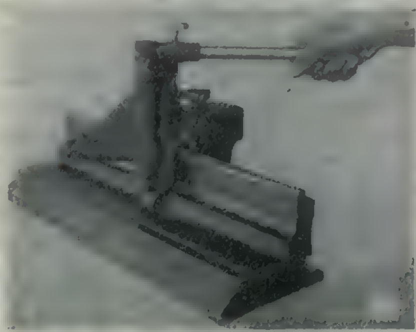


FIG. 4.

with the face of the wheel by traveling the table. As a matter of fact, straight grinding, where the work is not traversed, could be termed "form grinding."

Wheel Truing

No doubt the question will be asked, "Do you not have to true the wheel often, and isn't it expensive?" We must say that the wheel must be trued and must be trued often to keep its face as near perfect as possible, but the fact that the wheel is wide, and in many cases covering the entire length of the cylinder being ground, it is working upon the entire cylinder at once, while

FIG. 5.

a narrow wheel, dependent upon traverse for producing the cylinder, cannot, of course, be working on but a small part of the cylinder at one time.

Taking the original standard of width, which was $\frac{1}{2}$ in., and assuming a wide wheel of 12 in., we have 24 narrow wheels working at once on the cylinder. Now we have but to consume the same amount of time and expense in truing this wheel of 12 in. face as we would require to true 24 wheels of $\frac{1}{4}$ in. face, and, in return for our labor of truing, we have ground the piece of work in practically one twenty-fourth of the time.

Wheel Truing Expense

The fear of most people that the truing of the wheel makes grinding expensive is a natural one, but should be set aside. Work with close limits and severe requirements can only be accomplished in most cases by the grinding process. True cylinders, absolutely round within .0001 in. can be produced by no other means than the grinding machine. Hardened steel parts which must be shaped can only be brought about by grinding. It is a question of dollars and cents. A generous use of the diamond increases production, insures the accuracy of the product and gives satisfactory results, and, with this, different degrees of finish can be accomplished by truing the wheel so that the face will be smooth or sharp, thus bringing about the desired result.

The wheel is trued to the shape desired by using a diamond carried in an

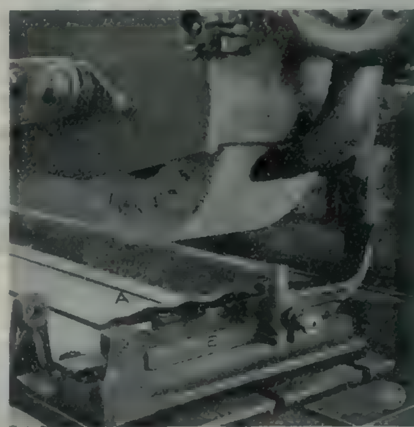


FIG. 6.

attachment designed for the purpose of producing this form.

On the line drawing are shown some illustrations of various shapes and forms that have been ground, which represent only a few of the possibilities of form grinding in connection with the following articles: Sides of skate blades, rifle barrels, gun barrels, pistol barrels, crankshaft bearings, roll necks for rolling mills, projectiles, pulley

FIG. 7.

faces, roll faces, ball bearing ball races, irregular shaped castings for machine parts, form cutters, shrapnel shell, etc.

Forming Devices

Forming devices may be divided into two classes—those which simply form a

radius or a concave in the wheel, and those which form irregular shapes. Attachments that form a radius or concave in the wheel are known as radial truing

FIG. 8.

devices, and are of a number of different designs, illustrated by Figs. 2 to 5. They can be applied to many designs of grinding machines, and all operate on the same general principle, that is, they swing about a fixed point which forms the pivot, and by varying the distance from the diamond to the pivotal point, with the wheel, variations in the radius formed are produced. They are used extensively for forming the corners of wheels to produce fillets on roll necks, crankshafts, camshafts, all forms of spindles, shafting, etc., and are more commonly used with the straight face wheel. The limitations are dependent on the distance that the diamond can be moved from the pivotal point, which in the smaller attachments amounts to 1 in. radius, and on the larger attachments up to 3 in. radius.

Means are provided for locking the swinging member of frame in a position where the diamond can be used for truing the straight portion of the face of the wheel, and as is evidenced from the

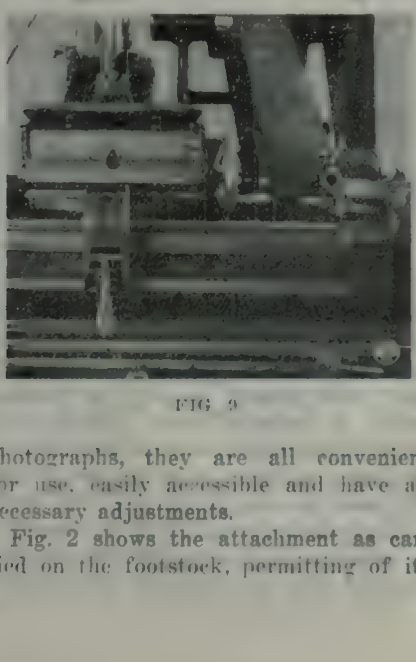


FIG. 9

photographs, they are all convenient for use, easily accessible and have all necessary adjustments.

Fig. 2 shows the attachment as carried on the footstock, permitting of its remaining in place during the operation of grinding work resting on the centres of the machine.

Fig. 3 shows an attachment which occupies a space on the table, and can only be used when the work is removed from the machine. It is quickly put in position and locked by a ball lever handle, and has the advantage of having the swinging frame supported at both ends, but with this design it is only possible to true a $\frac{3}{8}$ in. radius.

Fig. 4 is a fixture for truing a concave in the wheel, and this particular design is so arranged that each fixture is made for one particular radius, an adjustment of less than $\frac{1}{4}$ in. being provided. These attachments are built to take radii anywhere from 1 in, up to 12 in.

Fig. 5 shows a device for truing a radius on a wheel used on the surface grinding machine.

Forming devices, illustrated by Figs. 6 to 10 operate on a different principle. To get the irregular forms it is neces-

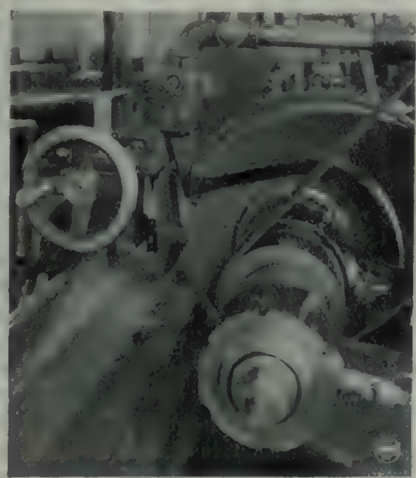


FIG. 10.

sary to first have a master form, which will cause the diamond to move through a path across the face of the wheel, which will produce the exact shape desired. This is clearly illustrated in the photograph (Fig. 6) of the attachment for the surface machine at A. As the roller travels across this former, the plate "B," carrying the diamond C is caused to move about the pivots D, making the diamond rise and fall, and producing the desired shape in the wheel. The movement is brought about by slide E which is actuated by the lever F fastened to the wheel slide. This is the same general principle employed in all of the forming attachments, modified only to suit the conditions under which they are used.

Fig. 8 illustrates this same type of attachment as applied to a cylindrical machine, the former plate being shown at A, the diamond carriage B, the diamond at C, the pivots at D, and slide at E.

Fig. 9 shows the same attachment mounted on the machine in place, ready for truing. Cuts and data are courtesy of the Norton Co., Worcester, Mass.

CHATTERING TAPER REAMERS.

HOW many of us at one time or another have been afflicted with a machine taper reamer that would insist on chattering, despite our every endeavor to "dope" it. Slow speeds were used in vain, and after stoning the cutting edges for half an hour, the next attempt at using it still produced a beautifully rifled hole. Sometimes this treatment was a success; sometimes notching the cutting edges improved matters.

All these remedies are at best only palliatives, as would be realized if one of the principal causes of chatter were fully understood. In nine cases out of ten it is due to an insufficient number of teeth in the reamer taken in conjunction with the weakness of the walls of the work.

To exaggerate the conditions, imagine the effect of forcing a rather dull three flute reamer into a thin walled tube. The result is that the walls take up a triangular form as the reamer alternately cuts and rubs. Similarly, in less extreme cases, the work assumes polygonal form according to the number of teeth in the reamer.

It is usually rather late in the day to attempt to cure a reamer of chattering when it is found to do so, for the fault is generally in the design. The remedy lies in using one with more teeth, and the designer will have to use his judgment as to the most suitable number for the job under consideration. This number cannot be increased indefinitely, as there must be sufficient chip space in the flutes. No hard and fast rule can be laid down for the number of teeth, and each case must be considered on its merits, working on past experience, the only reliable guide.

In the case of work with extremely thin walls, it is better to abandon a reamer altogether, using in its place a single point tool and the taper attachment. Another, though less common occurrence of chatter, is when small diameter reamers of proportionately great length are used. In this case the torsional stress causes them to twist up with the same result. The cure here is again by increasing the number of teeth, and thus strengthening the root diameter.

It may not perhaps be out of place to mention, in conclusion, that it is essential that reamer teeth should be unevenly spaced.—Herbert's Monthly.

PRODUCTION METHODS AND DEVICES

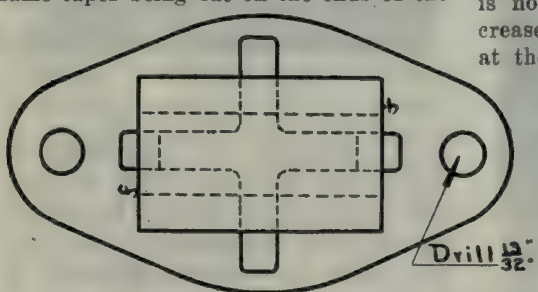
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A MILLING AND DRILLING JIG.

By D. O. Barrett.

THE drawing in Fig. 1 is that of a rocker arm bracket for a gasoline engine. It is a malleable iron casting and the foot or bottom is finished by disc grinding, the piece in this operation being held freely by hand as no fixture was necessary. It will be noticed that the two ends of the boss are machined and the whole through same is reamed.

After the bottom is disc ground, the ends of the boss are milled on the fixture shown in Fig. 2. This consists of a plain iron base plate A which is bolted to the milling machine table, being provided with keys on the bottom. The two arms BB are hinged near the centre and at one end are cut out to receive the foot of the bracket. At the back end of the plate, the stud S is rigidly fastened, and turning on this stud is a knurled nut N which is provided with a taper at the bottom, this same taper being cut on the ends of the arms B. The two arms are pulled together at this end by the heavy spring shown in the top view.



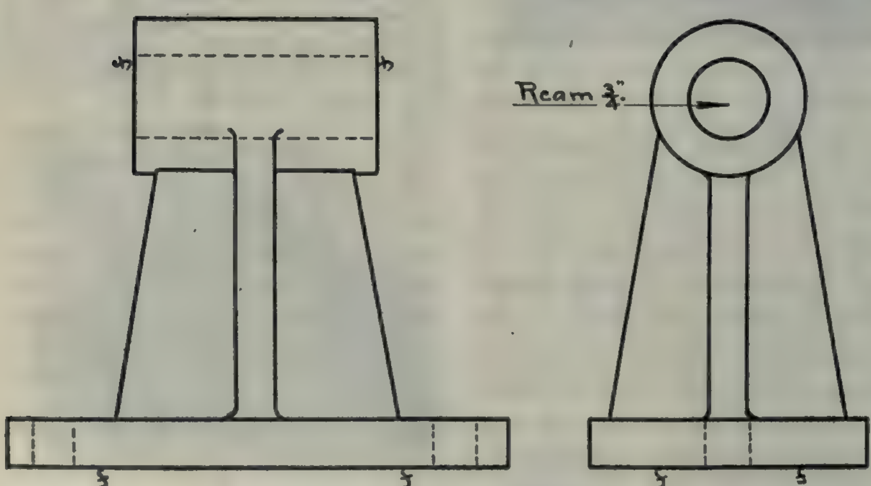


FIG. 1. ROCKER ARM BRACKET.

It will be seen that screwing down the nut N will force out the two arms evenly, and will thus accurately centre the piece held in the other end. The nut is provided with a coarse knurling, and the pressure necesary to operate this nut and clamp the castings very firmly is not great, as there is quite an increase of leverage. The shoulder screws at the front end of the arms serve to keep them in position and prevent them rising when clamping the casting. The clamp D holds down the castings by means of the eccentric arm at the top. This arm is attached to the eyebolt, so that any desired adjustment can be very readily obtained by turning this bolt and clamping at the bottom. A heavy spring not shown in the drawing, is slipped over the eye-bolt and pushes up the clamp D as soon as the arm is released. At the rear end of the clamp a hole is drilled which fits over a corresponding pin on the end of the large post, this post being screwed into the base-plate at the bottom. This keeps the clamp in position yet does not interfere with its vertical motion.

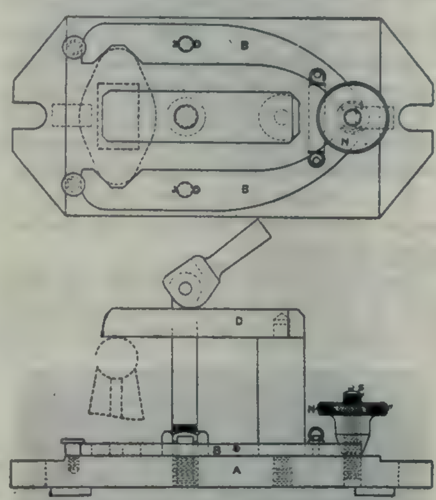


FIG. 2. MILLING FIXTURE.

After the ends of the boss are milled, the three holes are drilled and reamed in the fixture, Fig. 3. This is a box casting having a sliding steel V-block V which is operated vertically by means of the screw shown. The sides of the box are brought in at the bottom and are planed to the exact width of the boss on the casting. The back of the V-block is extended out and a corresponding slot is planed in the sides of the box, thus preventing the V-block from moving out as the pressure of the screw is brought to bear upon it.

In operation, the boss of the casting is placed in the V-block, and, by turning the screw at the top, the casting is forced up against the under side of the top. This accurately centres the casting with respect to the boss in both directions. A slip bushing is provided for the hole in the boss for reaming. The jig is slid along the drill press table between two parallels clamped to the same, and after drilling the two holes at the top, the jig is turned over one-quarter revolution and the large hole drilled and

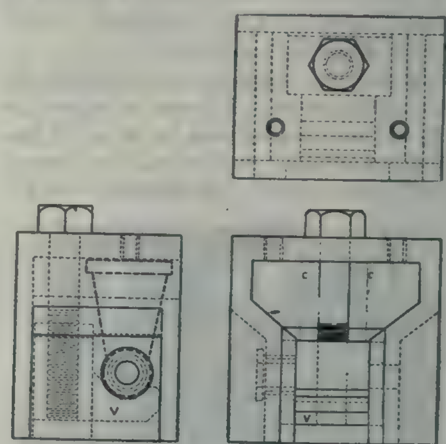


FIG. 3. DRILLING JIG.

reamed. This makes a fairly quick-acting device, but, what is more to the point, one that will accurately locate the part with respect to previous machine work. A hardened steel washer, not shown, was used between the head of the screw and the top of the box to take the wear at this point, and two heavy springs were placed along the lines CC in order to positively push down the V-block as soon as the screw was loosened.

FASTENING LOCK SCREWS.

By D. S. Mann.

WHERE set-screws are used to hold piston pins and studs, the usual practice is to either flatten the pin slightly where the point of the screw rests, or drill a shallow hole. These set-screws are prone to work loose, especially when used in gas engine pistons, even though they are provided with lock-nuts. The writer has found the following to be a very serviceable method, both for retaining the pins and preventing the screws from working loose.

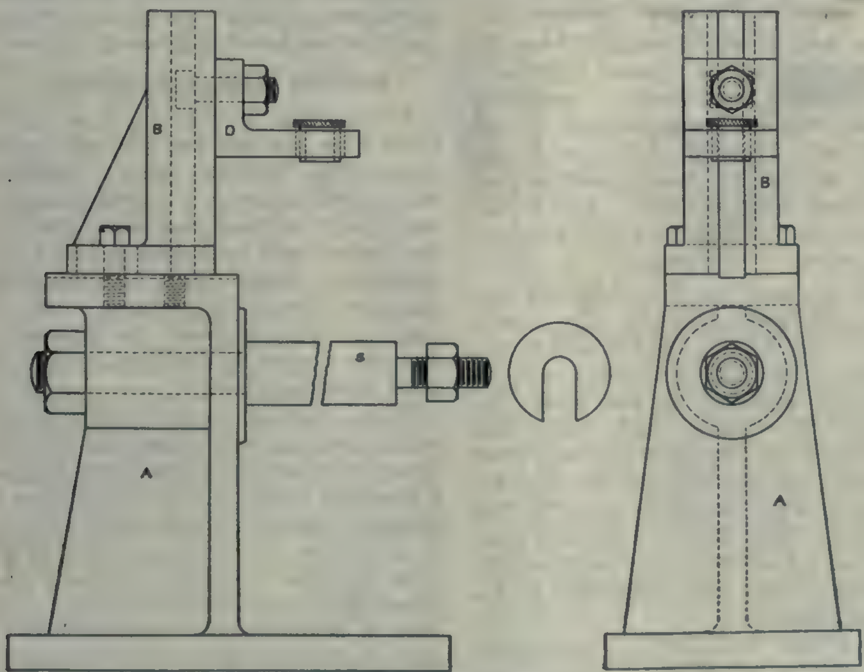
A hole is drilled in the pin about one thirty-second smaller than the size set-screw used, this being drilled to a depth of about one-half inch. For piston pins it is, of course, necessary to drill these holes before hardening. When the set-screws are put in they are run down the hole in the pin. The thread of the screw will, of course, cut a corresponding thread in the pin, and, if the pin be hardened, the thread will be flattened somewhat. The friction of the screw in the hole will successfully prevent it from working out, this being especially true where the threads have been slightly flattened.

AN ADJUSTABLE DRILLING FIXTURE.

By A. L. Loy.

IN the cut is shown an adjustable drilling fixture for such work as oil holes and set-screw holes for pulleys, gears, or collars. Where much of this work is done a multitude of fixtures would be necessary to cover all the requirements. This particular device is made adjustable in all directions so that the range covered is quite large. The amount of adjustment in each direction, of course, depends upon the work to be done, and will vary in different shops.

The base A is provided with a foot for clamping to the drill press table. The stud S carries the pulley, and is held in the piece A by means of a nut at the end. The outer end carries a nut which is small enough to pass through the hole in the pulley, while the pulley is held on the stud by means of a slotted washer which is dropped in back of the nut. The top of the base is provided with a plain groove in which slides the piece B, this being fastened by means of two cap screws. Slots are provided in B giving a similar range of adjustments parallel with the bore of the pulley, while several holes are tapped in the base piece allowing the cap screws to be placed in different positions. The angle D is arranged to slide vertically in B, this being provided with a T-slot. The sides of the slot are planed, and a corresponding key is fitted to the angle. The angle is provided with a fixed bushing so that various sizes of slip bushings may be used.



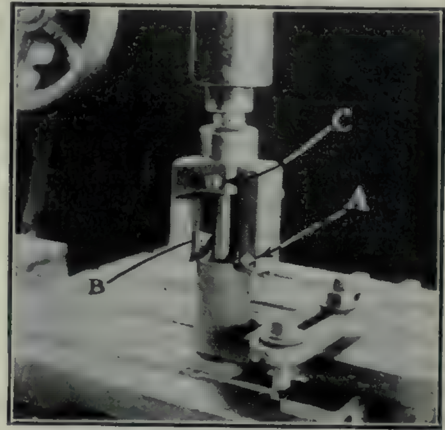
ADJUSTABLE DRILLING FIXTURE.

With much work of the varieties mentioned, a fixture of this kind will readily pay for itself in a short time.

HOLLOW-MILLING ROCKER ARMS.

By A. E. Granville.

ONE of the most awkward pieces of work to handle in a railroad shop is a rocker arm. These may be handled to advantage, however, on a radial drilling machine, or a good heavy plain one. The latter is not so convenient, as it requires more trouble to set correctly. The rocker arms may be clamped to the table, drilled, bored and reamed, and then hollow milled, as shown in the illustration.



HOLLOW MILLING ROCKER ARMS.

The tool is made from a steel forging made in the blacksmith shop, the two wings each carrying a cutter. These cutters are held in by set screws, one of which is shown at A, and are easily adjusted for different sizes. The pilot B is held into the body of the tool by means of a set screw C. Various sizes of pilots are kept for the work done and are easily substituted for the one in place.

Sometimes it is advisable to make these tools with only one arm and one cutter, in which case the work becomes a turning operation and not a milling one. While slower, a single cutter has a number of advantages that need not be explained to a practical mechanic.

NOISE is a very important cause of industrial accidents. Noise and fatigue might properly be coupled together, because fatigue is often the direct result of noise. Be this as it may, it is certain that noise is often the direct cause of accidents, a typical case being that in which a machine slipped from an overhead crane and fell on to a workman. The crane operator saw the machine slipping and shouted to the workman but was unable to make him hear because of the noise in the shop. Steps toward the elimination of unnecessary noise are now being taken by the managements of progressive industrial plants. Not only is this a means of providing for the safety of the operators, but experience has shown that more work can be done in a quiet shop, that there are apt to be fewer mistakes made, and that the quality of the work will be improved. These are certainly points that the up-to-date manufacturer cannot afford to overlook.

Notes and Observations on Modern Foundry Practice—*

By R. Onions

In the introduction to his paper, the author referred to the fact that the art of ironfounding was in existence previous to the written records of history. He at the same time hazarded the suggestion that to the scientist and practical man of to-day it offered not only a wide field for research, but one also in which individuality had the widest possible scope.

IN these strenuous war-time days, the iron foundry is not conspicuously prominent either in its production of war munitions or its development demonstration. Its devotees are neither idle at the desk nor on the floor, however, and, if for the nonce, the steel mill and the forge divide the honor of premier place in industrial engineering enterprise, the day is becoming appreciably nearer when the iron foundry will again assert its claim and demand whole-hearted attention.

In what follows in our present and immediately succeeding issues, sufficient of the substance of the subject matter discussed by the author in his paper will be reproduced, so as to give an idea of the comprehensiveness of the detail embraced and incidentally re-awaken the interest of foundrymen to the achievement possibilities of their craft and calling.

Core Making.

Good results are obtained by the use of sea sand and oil for certain classes of core work, such, for instance, as the core required for the combustion chamber of gas or oil engine and steam ports of cylinder, where the core is entirely surrounded and good venting is necessary. A man will take five or six hours to make the water jacket core irons for a gas engine of 100 h.p., and a great deal of care is necessary to have the vents from all the parts to the outlet. Such a core is well suited for oil sand, and, when it is used, no grid is required, as the core dries so hard that a few irons crossed and tied for lifting purposes are all that is wanted.

It is difficult to understand why oil sand cores are not more widely used. The labor question has a considerable influence, but when judiciously introduced and men see that they will work satisfactorily, they are looked upon with more favor. One objection to guard against as far as possible is the smell from fish oils. Two parts of whale oil and one part of boiled linseed oil work well.

The bending of core irons in wooden core boxes is responsible for a good deal of damage, involving pattern shop repairs. Bad work and delay creep in if patterns and core boxes are allowed to deterioriate. A periodic examination and general clean up and varnishing is good practice; it leads to the worker taking more interest in his job; and tends to recruit a better class of man.

When quantities enter into the question, labor-saving devices should be considered, and by attention to details which go towards eliminating the fatigue of the operator, particularly where girl labor is employed, the output will be enhanced. It should, therefore, be an axiom not to do anything by manual labor which may sensibly be performed by power. The illustration on next page shows such a device, being a pneumatic core box cramp, which is operated by the opening or closing of the air tap.

Green or Dry Sand Castings.

The main points to consider when deciding what castings to make in green or dry sand are, the amount of machining on the finished piece, the cost of the mould and the number of cores it contains; the risks in closing, and the class of skilled labor available. The human element also steps in to a very considerable extent.

For dry sand, one first class, and, say, three indifferent moulders, may form a squad. The leading hand should be employed in finishing and closing, and the others in ramming up and partly finishing. For green sand, every man must know his job, the drying very often making good the defective venting and ramming which would be quite fatal to the green sand mould. Dry sand castings are not so sharp as green sand; the difference being quite noticeable in fine pattern work.

There are many quite elementary points which are found in actual practice to be missed, and so cause serious leakage in the way of lost work. A pipe for example should not be rapped sideways, but tapped lightly on both ends with a wooden mallet. Rapping sideways tends to disturb the sand along the edge of the box, nevertheless, it is the practice with moulders to loosen pipe patterns sideways. The advent of the moulding machine with its vibrator has shown that patterns of quite moderate size can be satisfactorily loosened by quite light tapping. Gaggering of dry sand moulds is generally much overdone, and it is one of the many details of moulding where men may be working hard and still wasting their time. In ramming a green sand mould, care should be taken never to go too close to the pattern, as this is the sole cause of many scabs. Pneumatic rammers shake the arms, and, partly owing to this, the moulder cannot feel the degree of hardness the same as with the hand tool.

Compressed air service at 80 to 100 lb. square inch pressure with convenient connections for india rubber tubing is an advantage for blowing but dust and pieces from deep dry sand moulds. The same connections may be used for crude oil burners, which are sometimes used instead of coke buckets for skin drying green sand molds. Iron molds may be made to supersede a good deal of open sand castings, such as grids, anchors for holding down bolts, core grids and such castings that have taper on all sides.

Moulding Machine Advantages.

The foundry in order to be on equal terms with the machine shop must produce with precision also. Castings which are uniformly rammed, loosened and drawn by machines must score in this respect over those produced by hand moulding. Some form of moulding machine where the pattern plate is easily and cheaply made, and is capable of being worked by unskilled labor, is a great advantage.

When making wood patterns, the management cannot always say whether or not any particular detail may become a standard design before trial, and so a difficulty comes in to determine whether it should be machined moulded. Patterns intended to produce moulding machine plates are sometimes required to have a double contraction. This difficulty is best met by adopting a class of metal which will have little or no contraction; the material should also resist corrosion and not be too brittle. The following mixture of metal is cheap and meets the conditions well:

Lead	85%
Antimony	10%
Tin	5%

In all moulding machines, except the class where a stripping plate is used, the method of first starting the draw should be so under the control of the operator that any degree of movement may be obtained whilst the vibrator is still in action, as moulders know it is on the first attempt to disturb the pattern that damage may be done.

*From a paper read recently before the Manchester Association of Engineers.

Centres of pin holes and sizes of boxes are important matters to determine, as they soon multiply in number, and changes afterwards cannot well be made. These dimensions are settled by the class of work and when decided upon, jigs are necessary for drilling pin holes in frames of machines which will correspond exactly with those in moulding boxes. Good jointing is essential for accurate work, and this can only be obtained by keeping all pins and holes in good condition. The holes stand well if bushed with 3 per cent. nickel steel, and pins resist corrosion when made of the same material.

Plate Moulding.

Plate moulding may be said to come between the ordinary moulding with loose patterns and the moulding machine. Like all other classes of moulding, it has its sphere of usefulness in practically every foundry. The principal advantages gained are that by it a good joint is assured, the plate being extended over the box, the pins forming a guide when drawing the pattern off by hand, so that less patching and mending is required, and the castings in consequence come out cleaner and nearer to the actual size of patterns. The machining allowance can also be less.

The general trend of engineering demands from the iron founder more complicated castings, capable of standing higher fluid and gas pressures, greater stress and sliding surfaces to work satisfactorily up to 900 ft. per minute, and to have test pieces cast which must satisfy severe transverse and tensile tests. The foundry man meets the conditions demanded sometimes by the grading of metal or the placing of running gate or risers over particular places, whilst cases will occur where all ordinary methods fail and the desired result after many trials is only possible by the application of a chill or densifier at some particular spot.

Chills.

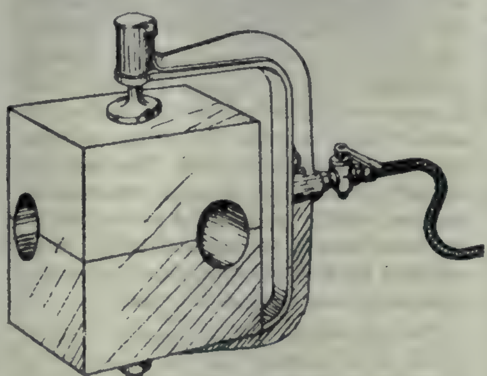
Chills may be cast in the body of castings and remain as part of the finished product, as in the case of flywheel bosses, where a ring of cast iron may be placed in the heavy section, but clear of the machined surface. We have also the class of chilling to obtain from one grade of metal, two distinct grades in the casting, such as a hardened surface to stand wear. The hardness or denseness obtained bears a relation to the respective massiveness of the chill and the casting, or the time they are allowed to be in contact. In applying chills, it is therefore necessary to leave the surface so that it can be machined and to have the chilling effect so deep that after machining the surface is sufficiently hard.

Various types of fettling-shop rumblers capable of holding up to five tons, are made, and these seem to impart some property which appears to be beneficial, probably by helping to set free contraction and skin stresses, and so making the casting more normal in this respect.

Cupola Management.

The cupola and its management may be considered the section of ironfounding offering the widest scope for investigation, and considerable skill and experience must be exercised in the design, building, and working if the operations are to be carried out to give, in regular work the best results.

Amongst the many modifications or special appliances added to the ordinary cupola which have for their object the reduction of coke consumed per ton of iron melted, probably the one which makes the strongest appeal is that patented by Greiner and Erpf. These inventors claim that with a second row of comparatively large tuyeres the burning is so concentrated, and thus the temperature maintained is so high, that the carbon dioxide formed is sufficiently hot to react on hot coke and form carbon monoxide again. Their cupola has one main row of tuyeres, and then a series of small tuyeres distributed for a considerable distance up the cupola. The idea of this arrangement is, that by supplying the extra air in small quantities, they burn all the carbon monoxide without raising the temperature of the coke high enough to be followed by the reaction of the carbon dioxide again.



PNEUMATIC COREBOX CRAMP.

Experiments have been made with the Greiner and Erpf's air distributor and other experiments with the ordinary tuyeres in the way of sending the blast in different directions, such as obtaining a swirling motion, directing the blast downwards and with the openings made to increase the velocity to send the air to the centre. These went to confirm that the tuyeres arranged horizontally and directed towards the centre, with an increasing area to give a soft and well-distributed blast, having a velocity not exceeding 2,500 ft. per minute, will give good all-round results; the lining under these conditions being easily repaired and the shape readily maintained.

A receiver attached to the side or bottom of a cupola appears to claim a good many advantages. By mixing thoroughly the various grades of metal, and by allowing the metal as it melts to flow away from the influence of the coke, it will pick up less of its impurities. It also has the advantage that, by taking away the slag, apart from the furnace proper, the coke is not brought down so quickly; on the other hand, it takes a little longer to get hot metal than is the case with the ordinary cupola.

Attempts have frequently been made to economize the fuel by connecting the top of the receiver to the cupola and so making use of a hot blast. With such an arrangement difficulty is experienced owing to the connecting pipe getting choked with a kind of slag deposit, impinged quite hard against the interior, in the form of sparks. Temperature has a considerable influence on the microstructure of castings. For one cause or another, various castings have to be cast at different temperatures, so that practically every casting will have a corresponding casting temperature to suit all-round conditions.

Castings Cost.

When considering the question of costs of castings, we must look at it from a point which goes beyond the foundry—as, after all, this is only one of several sections of an engineering works which go to make the whole. Here, then, it is necessary to exercise a good deal of sound judgment, which can only come by long experience. For instance, a slight increase in foundry costs may result in a large decrease in finishing costs. Certain holes, say, in a bedplate, may do quite well if cored, but from their position in the mould the risk of a "crush" may be too great to set against the drilling time.

Management and Organization.

On drawing this paper to a close, it may be as well to pause for a moment and ask ourselves the question, "What does successful iron founding mean?" However necessary good equipment and tools may be, they are useless in the hands of bad management and poor organization. It may be conceived on this score alone that the so-called out-of-date shop may beat a foundry equipped on the most up-to-date lines. Clearly then it is not so much the equipment we have to look to, as the supervision and the skilled men of the foundry, and as they are the men who earn the profit, everything possible should be done to relieve them of anything which may take them off their job—in short, the skilled man is no use when laboring.

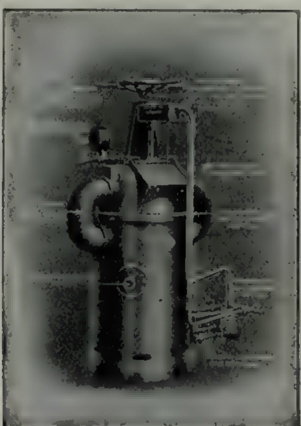
PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

AN ALUMINUM FURNACE.

THE application of aluminum and its alloys to industrial purposes has extended so considerably in recent years that the subject of their melting is bound to appeal to a large number of manufacturers. Generally, the melting of these metals has been effected in open crucibles, which allow atmospheric oxygen to attack the molten metal with the consequent formation of dross. Other drawbacks to melting aluminum in this manner are well known to those familiar with the subject. A gas-fired furnace, on what are claimed to be entirely new principles, for melting aluminum and its alloys has been evolved after many experiments by the Monometer Mfg. Co., of Aston, Birmingham, England.

Melting pots made of metal are subject to the objection that the re-action



AN ALUMINUM FURNACE.

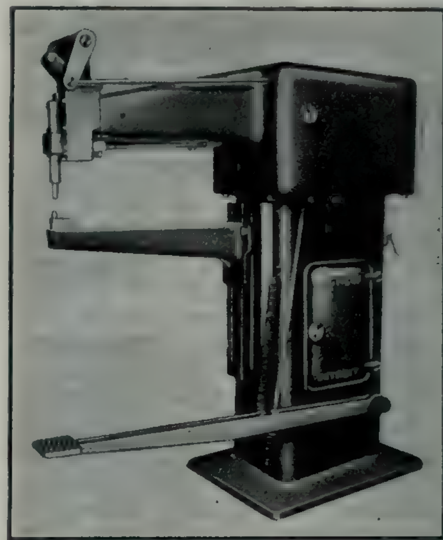
which takes place between the molten aluminum and the impurities in the metal of which the pot is composed, spoils the aluminum. In the furnace in question, this re-action is claimed to be eliminated by the employment in the parts subject to attack, of a special composition of metal, which extended experience has shown to be perfectly resistant to the action of impurities. It is well known that a considerable proportion of the molten metal goes to waste as oxide, and to prevent this deleterious action, the melting pot is installed in a chamber containing inert gases incapable of oxidising the molten metal. As there is no oxidation, it follows that there is no dross, and hence considerable saving of material. The method of constantly replenishing the enclosed melting chamber with inert gases, consists in causing the products of combustion to traverse the melting chamber on their way to the outer flue. This sealing of the melting chamber precludes, further, the ingress of dirt and other foreign matter to the melting pot.

Turning to the heating arrangements, we find that a very ingenious device is incorporated in connection therewith, in order to take care of the gas supply when the melting point of the metal has been reached. The thermostat of the patented regulator, termed by the makers a "Monometer," controls and governs the quantity of gas supplied to the burners, so that immediately the aluminum is melted the quantity of gas combusted by the burners is reduced and the uniform heat essential to the melting of aluminum is automatically maintained. The Bunsen burners under the melting pot are of novel construction, having contracted nozzles of such a design that a proper admixture of the gas and air is secured and therefore the fullest utilization of the heat in the fuel. The heat obtained by these low pressure atmospheric burners, which are coupled to the ordinary town supply, is comparable with that attained by high-pressure gas, but without using compressors or fans.

The equipment of the furnace is completed by a central cone valve seated in the bottom of the melting pot and controlled by a conveniently arranged handwheel by which the molten metal issuing from the pouring spout can be regulated or entirely shut off. At the top of the furnace are located two doors through which the swarf or metal is introduced into the melting pot, these doors being balanced so that they remain either in the closed position or in the open position, without being held by the operator. To facilitate casting, the furnace is mounted on a wheeled carriage which can readily be moved on the rails from one part of the foundry to another, flexible gas pipes being, of course, a necessary auxiliary.

ELECTRIC SPOT AND BUTT WELDING MACHINES.

IN the new line of electric welders recently brought out by the Agnew Electric Welder Co., Detroit, Mich., the most important are two spot welders and a butt welding machine. A feature of both spot welding machines is that the working points are water cooled by hose and pipe inside the machine underneath the transformer. The high-tension wires are also housed inside the frame so that accidental contact with them is impossible. The regulating panel is inside the frame, access to it being through the

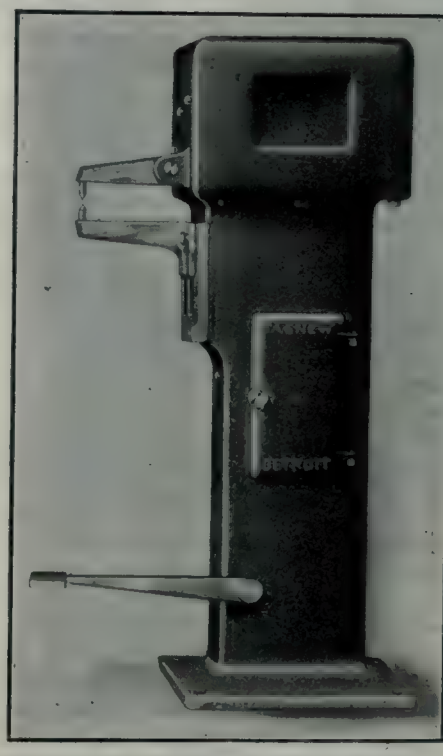


NO. 20-D SPOT WELDER.

door on the side of the frame. All working parts of both types are accessible and designed for hard service.

The 10-D Spot Welder.

The smaller or 10-D machine is of the pivoted type, and is equipped with a foot lever which automatically applies the current, the operator having free use of



NO. 10-D SPOT WELDER.

both hands. A regulating switch for welding any thickness of metal within its capacity of No. 18 or 14 gauge steel is provided. The depth of the throat is $10\frac{1}{2}$ in.; the adjustment of the lower horn, 6 in.; height from floor to work points, 41 in., and transformer capacity, $12\frac{1}{2}$ kw. This machine will make 500 welds on No. 18 gauge; 900 on No. 22 gauge; 1,500 on No. 26 gauge, and 3,000 on No. 30 gauge steel with a current consumption of 1 kw.-hr.

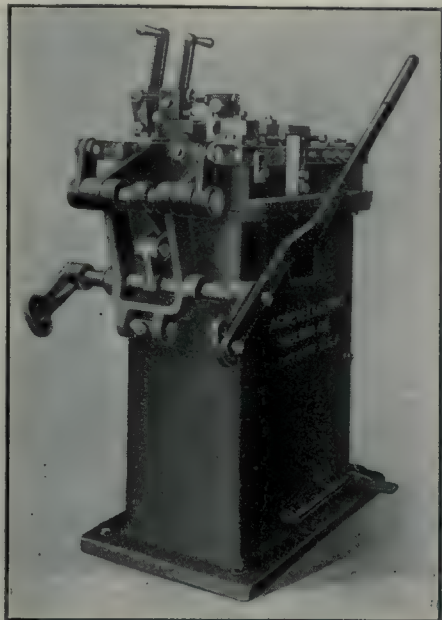
The 20-D Spot Welder.

The larger type of spot welding machine, the 20-D, has an adjustable horn, so that, with the use of a long point, welds can be made at the bottom of deep cylinders, battery and tool boxes, etc., and the horn is arranged so that any kind of attachment can be put on it for welding on the inside of odd shaped pieces. In this machine the up and down movement of the upper electrode is secured by toggle joints. It is regularly equipped with a foot lever which automatically applies the current, but a hand lever may be attached if desired. Regulation is provided so that metal of light thickness may be welded without danger of burning. The transformer is designed for continuous and rapid service up to its capacity without overheating. Its welding capacity is No. 10 gauge steel and lighter. It is made in four sizes with depths of throat of 18, 24, 36 and 48 in. The adjustment of the horn is 10 in. and the height from the floor to the working points is 40 in. The transformer capacity is 20 kw. The machine will make 160 welds on No. 10 gauge steel; 350 on No. 16 gauge; 900 in No. 22 and 2,250 welds on No. 28 gauge steel with a 1-kw.-hr. current consumption.

The 20-C Butt Welder.

The butt welding machine, designated as the 20-C, has a number of special features including an extended movable rear carriage which is pulled against the work instead of being pushed, to prevent any tendency of the work to buckle under heavy pressure. The carriage slides in ways located at the front and rear of the opening. The extended movable carriage adds to the rigidity and allows the bearings to be located so that particles of chilled metal cannot get to them and cut the bearings. The movable carriage is gibbed to take up the wear. The forward carriage is adjustable vertically and crosswise, making it unnecessary to shim or remachine this to correct alignment. The necessary pressure is applied by a vertical lever operating a compound toggle movement that is adjustable to secure the greatest leverage at any desired position of the carriage.

A second lever is attached on the rear, and the machine is operated by two men, avoiding the necessity of using a hydraulic ram on heavy work. It is equipped with clamps for welding either rounds or flats. A current regulator and water-cooled dies form a part of the equipment. The machine illustrated has a welding capacity of $\frac{1}{2}$ to $1\frac{1}{4}$ in. rounds



NO. 20-C BUTT WELDER.

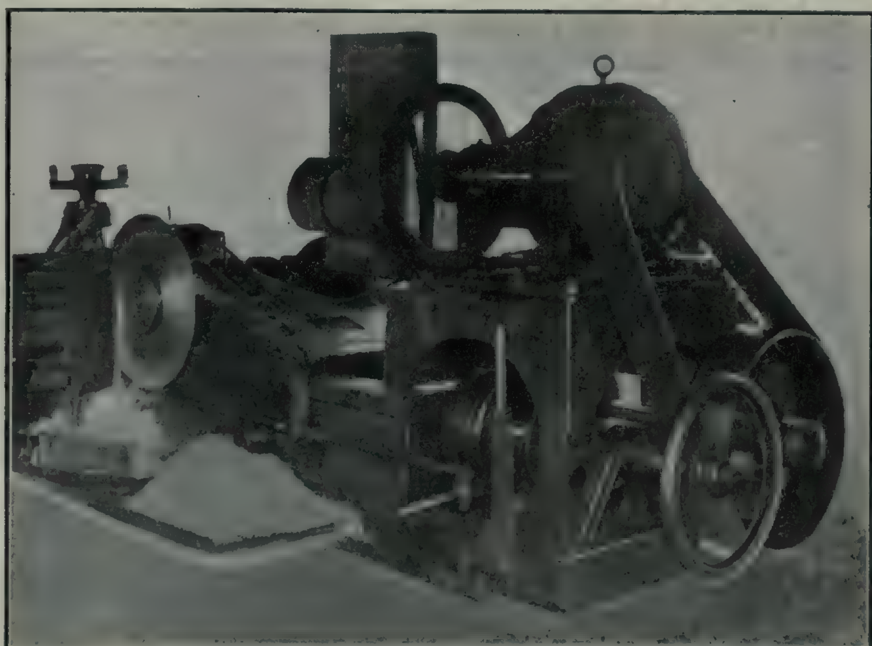
or $\frac{1}{8}$ x 7-in. flats. The stroke of the carriage is 4 in. and the carriage opens $4\frac{1}{2}$ in. The height from the floor to centre of work is 42 in.; the floor space is 22 x 34 in., and the transformer capacity is 30 kw. This machine will make 11 welds on $1\frac{1}{4}$-in.; 18 welds on 1-in.; 38 welds on $\frac{3}{4}$-in., and 135 welds on $\frac{1}{2}$ in. round bars with a current consumption of 1 kw.-hr. It is also built on three other sizes, two smaller and one larger.

MULTIPLE BAR SAW.

THE manufacture of shrapnel and high explosive shells has been responsible for an extraordinary display of ingenuity in the matter of production methods and devices applicable to standard equipment. No less true is it that relative to special purpose machine tools, there has been an equivalent degree of achievement. In the operation of sawing the shell billets to length from the steel bars as received from the mill, the illustration shows one of seven Espen-Lucas Machine Works, Philadelphia, saws installed at the plants of the Steel Co., of Canada, Hamilton, Ont.

These machines are very heavily constructed, and with a Westinghouse back geared motor drive, a periphery speed of 30 feet per minute is got at the saw, as well as sufficient power to carry any reasonable feed per minute. This combination is a very desirable one from the standpoint of the life of saws. The machine is equipped with multi-bar holding jigs, holding five bars at one time, the bars beng jigged in circular form, so that the time of cutting one piece really covers the time of cutting all of the five.

The saw blades are of vanadium steel, and the saw teeth of the best high speed steel. All the bearings on the machine are bushed with bronze, while all steel parts are made of high carbon forgings. The feeds are variable and automatic, and are furnished with automatic throwout, which disengages the feed at any predetermined point. Automatic quick return withdraws the saw blade on completion of cut, and all operating levers are located conveniently at one point.



MOTOR DRIVEN MULTIPLE BAR SAW.

The saws range from 30 in to 34 in. diameter according to the size of the work, and the weight of the machine shown runs to about 16,000 pounds.

100-INCH DRIVING WHEEL LATHE.

A RECENT product of The Niles Tool Works Co., Hamilton, Ohio, is that of a 100-inch driving wheel lathe. The accompanying cuts show the general design of the complete machine and one of the face plates in detail respectively. The capacity ranges from 32 7-10 ins. to 94½ ins. diameter on the tread. The maximum distance between face plates is 11 ft. 2¼ ins., and the minimum distance is 6 ft., 8 ins.

The face plates are 100-in. diameter and are arranged with recesses so that the outside cranks can enter and permit sliding members carrying centres to be located in proper positions. For holding the wheels, "Sure Grip" drivers are provided, four to each face plate. These engage the tire directly and hold wheels absolutely rigid under heaviest cuts.

The face plates are driven by large diameter gears bolted to their back faces. The driving pinions which engage the face plate gears can be thrown out of mesh so that the speed of the left hand face plate can be increased through an auxiliary train of gears when the machine is used for journal turning. To facilitate handling wheels in and out of the lathe an independent motor of 10 h.p. is provided for traversing the right hand head. The drive is through a friction clutch controlled by a lever placed at the front of the machine, within easy reach of the operator.

The bed, which is of massive construction, is 22 ft. x 11½ in. long. The front portion, upon which the carriage rests, is moved out 10½ ins. from the main bed. The maximum distance between face plates permits wheels with outside counter cranks to be rolled into the machine without interfering with the driver dogs on the face plates. Tracks

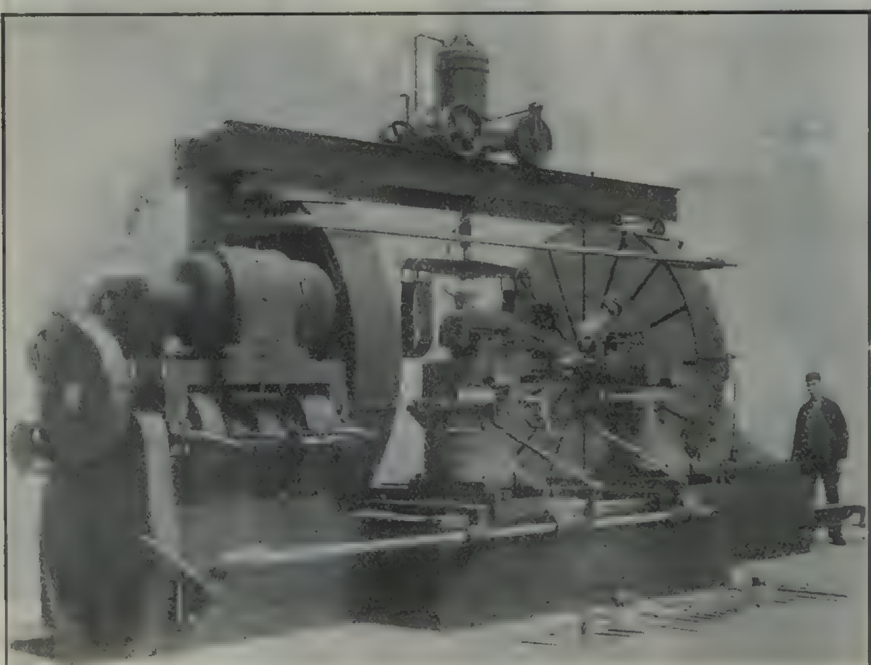
FACE PLATE DETAIL OF 100-INCH DRIVING WHEEL LATHE.

are located on the bed, so that wheels can be rolled to the centre of the machine.

Tool rests are of massive construction and are arranged to swivel to give the proper angle for the taper of the wheel tread. The tool rests are equipped with pneumatic tool clamps, which hold the tools rigid or release them instantly by a hand operated valve, making possible the changing of tools in a few seconds.

The drive is by means of a 30 h.p. direct connected motor, having a speed range of from 500 to 1,500 h.p.m. Through an auxiliary train of gearing suitable speeds are provided for journal turning.

The machine is equipped with a pneumatic hoist, carried on two 12 in. channels located above the machine. The hitch to the axles is made by using two slings of belting. The standard calipering attachment consisting of a bar and gauge is provided. The machine is also equipped with an Andrew's calipering attachment, which consists of scales counter-sunk in the carriage and fastened to the tool slide base, together with a bar for setting the tool.



100-INCH DRIVING WHEEL LATHE.

WHY NOT?

SOME years ago when the advantages of the limit gauge system were not as widely known as they are to-day, the writer, to impress one young fellow with the beauties of the system, took a gauge of the correct size for the work in hand and explained that one end of the gauge must go in and the other end should not.

After waxing enthusiastic, a very eloquent peroration was concluded with the remark that the hole being bored would then be less than one end of the gauge, but greater than the other end. The operator, however, remained quite unmoved, and quietly remarked that "it was about one of the silliest schemes he had ever come across; why not have a gauge of the correct size?"

WAR EFFECTS.

Many shops will have an excess of plant.

They will have learnt new methods on the new machines they have installed for war requirements.

The old machines will no longer be able to earn their keep; they were not really able to do so before, but the fact had not yet been discovered.

It takes a war to wake up some people.

Much of the old plant will be discarded.

The new methods will become standard practice.

The demand for modern tools will be greater than ever.

Let us hope that this will be the case, but we must first win the war.

MacKinnon, Holmes & Co., Sherbrooke, Que., are completing the erection of a shell forging plant. The equipment part of which is now installed will turn out about 1,000 forgings per day for 4.5 high-explosive shells.

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Vol. XIII. JUNE 17, 1915 No. 24

PRINCIPAL CONTENTS.

NATIONAL ORGANIZATION OF LABOR.

AMONG many other things forcibly brought to our notice by the present international struggle is the absolute interdependence of the soldier and the maker of munitions for military success. Just as the miner, the steel worker, and machinist form a much larger element than the actual trainman in the success of a railway, so the men who stay at home may contribute a very large share to the defence of the nation.

The British army has more than upheld its most glorious traditions in the field, but has been handicapped by the insufficiency and inefficiency of the armies in the workshops at home. Great Britain has experienced less difficulty in the securing of three hundred thousand recruits for the army than in getting thirty thousand additional mechanics. The inventory and organization of factories and of the men employed therein has, however, now, become a department of the Imperial Government, and gives promise already to solve the problem of the army's mainstay.

The ability and promptness with which Canada has taken hold of a share of the manufacture of war supplies has been a source of astonishment to many foreign countries and the Canadian people have not been slow to accept such credit as has been accorded them. Canadian manufacturers and mechanics, however, are still far from doing their share, or more properly, have not been tested out to their capacity. According to population, the Dominion should furnish from one-seventh to one-eighth as much war material as is delivered by Great Britain, and on the basis of natural resources, a great deal more.

Canada is a far-flung country and furnishes a wider scope for organization than almost any other. To-day, while the manufacturer of munitions in one part of her territory is calling for men, there are suitable mechanics looking for jobs in another. It is said that Germany recently sent 4,000 skilled mechanics to Constantinople to build submarines and war machinery for the Turks. Would it not be a humane and patriotic duty as well for both our capitalist and labor organizations in this instance, to bring the man to the job and save him the necessity of replying to the more active efforts of foreign advertisers. The circumstance offers a valuable opportunity for labor and capital to get together and to give cooperation a thorough and conscientious tryout.

Facts are becoming known which indicate that Canadian skill and resources are not being organized to do all they can to serve the Empire at this momentous epoch in its history. The head of one of our leading industrial plants—as loyal a son of Canada as ever trod her soil—laid before us the details of an offer received from the Government of France for the supply to our ally of 500,000 shells, for delivery during the ensuing months of this year and the beginning of next. It was not a mere request for prices, but a request preferred because of the reputation for thoroughness and reliability which this firm has earned for itself.

France, as well as Britain, needs shells, and her agents are seeking those with the equipment and skill to supply them. To get them a good price is offered—better than from British authorities—and courteous and satisfactory assurances are given that as soon as the shells are delivered, as required, the cash will be handed over. More than that, our ally goes further and offers to the experienced and skilled manufacturer, a deposit with the order.

Attractive as this offer is, it will in all likelihood be turned down, not because of the price, unavailability of raw material, or doubt as to payment, but because of uncertainty as to labor. Strange as this may seem, in view of the campaign to take men from Canada to Britain, it is nevertheless true. While city officials are asking for assistance in "making work" for the unemployed, manufacturers are anxious lest they should fall down in the delivery of orders on hand through the steady drain on their staffs by the demand of Britain.

A shell made in Canada is as effective as one made in Britain. To take from Canada a man to make a shell in Britain is wasteful to the extent of the cost of his transportation, inasmuch as he could be made as serviceable in Canada as in any other part of the Empire. Canada has the plant to make munitions in Canada, the skill, the material, and the will, but nevertheless orders are going to the States because of the uncertainty due to the campaign to induce our mechanics to go to Britain.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2,15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled.	14 00	14 00
No. 1 machine, compos'n	12 50	12 50
No. 1 compos'n turnings	9 25	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	5 50	5 50
Teal lead	$4 25	$4 25
Scrap zinc	17 00	17 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 3, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	39	....	....
½ in.	68	48	....	....
¾ to 1½ in.	73	53	....	....
2 in.	73	53	69	49
2½ to 4 in.	73	53	72	52
4½, 5, 6 in.	....	....	70	51
7, 8, 10 in.	....	....	67	48
X Strong P. E.				
¼, ⅜ in.	56	39	....	....
½ in.	63	46	....	....
¾ to 1½ in.	67	50	....	....
2, 2½, 3 in.	68	50	....	....
2 in.	....	....	63	47
2½ to 4 in.	....	....	63	50
4½, 5, 6 in.	....	....	66	50
7, 8 in.	....	....	59	42
XX Strong P. E.				
½ to 2 in.	44	29	....	....
2½ to 4 in.	....	....	44	29
Genuine Wrot Iron.				
⅜ in.	57	33	....	....
½ in.	62	42	....	....
¾ to 1½ in.	67	47	....	....
2 in.	67	47	63	43
2½, 3 in.	67	47	66	46
3½, 4 in.	....	....	66	46
4½, 5, 6 in.	....	....	63	44
7, 8 in.	....	....	60	41

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 50
Electrolytic copper	20 75	21 25
Castings, copper	20 50	21 00
Tin	45 00	45 00
Spelter	30 00	28 00
Lead	8 00	8 00
Antimony	40 00	40 00
Aluminum	32 00	24 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.15½
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40 to 45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Shets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 25
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	5 40	5 40
Queen's Head, 28 B.W.G.	5 50	5 50
Fleur-de-Lis, 28 B.W.G.	5 30	5 30
Gorbal's Best, No. 28	5 50	5 50
Viking metal, No. 28	5 00	5 00
Colborne Crown, No. 28	5 30	5 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., June 14, 1915.—The recent appeal for more shells has apparently had its effect, for in all channels, increased activities are being evidenced. This business has seemingly thrown all other lines of trade into the background. Our steel interests are putting forth great efforts to get some French and Russian orders for shells placed in Canada, and these, being of large proportions, would, if placed here, give a tremendous impetus to our steel industry.

The iron ore and pig iron situation remains very quiet, and not much change need be anticipated before the end of hostilities.

Regarding the machine tool situation, matters are from week to week becoming more congested in lathes, most machinery houses transacting business along lines not unlike those of the stock exchange. Machines are bought and sold all in one day in many cases, while orders over the wire and telephone are quite common. The metal situation is showing the effects of the tremendous drain due to the extraordinary demand for munitions of war manufacture. Lead, spelter and copper are those which seem to be most in evidence this week.

The Steel Trade.

Rail orders are being received in small quantities from time to time. The main proposition engaging the attention

of the steel mills at present, however, is the supplying of steel bars, billets, forgings, etc., for the manufacture of shells. In the course of a few months it is confidently expected that the manufacture of shells in and around Montreal will be greatly in excess of the even now huge proportions of the industry. At present the forging capacity of the various shops rather controls the situation. Nothing definite with regard to the extension of forging plants is meantime available, although great efforts to increase the output are being made. The rolling mills are arranging to take care of the heavy demand which will arise as soon as forging machinery can be installed. At the moment, steel men are awaiting development, and none contradict the fact that big things are in process of maturing. Foreign and overseas business with the colonies is in a ripe state to develop along extensive lines as soon as ships are procurable to carry the steel.

Pig Iron.

Everything is very quiet in pig iron. Most foundries are still closed down, while others are only running on short shifts.

Machine Tools.

The entry of so many firms into the manufacture of high explosive shells has caused further congestion and increased excitement in the machine tool trade. Heavy lathes up to 36 in. swing are in a greater demand than perhaps the world has ever known. The methods of handling this business are rather new to the trade. Manufacturers buy from one another to fill their respective orders and orders are received by wire or phone and accepted. Lathes are thus often shipped by the time letter confirming the order is received. The number of machines being sold is astonishing. It is hard to describe the situation, because to-day's description will hardly fit to-morrow's conditions.

Supplies are selling well and there is a great demand for high-speed steel. Jigs and fixtures are becoming more or less standardized and are finding a ready and free market.

Special machines for certain jobs and operations are being marketed with great success. Small millers to replace taps for operations on high explosive shells are commanding much attention, the taps on the market being apparently unsatisfactory.

Metals.

The metal situation is developing new features each week. Copper is stiffening in price and will no doubt go higher. The demand for war munitions is increasing steadily. There seems to be more copper required every week. Unfortunately, a great deal of the copper used for driving bands on the shells will in all probability never be recovered. That entering into brass cartridge cases, of course, will not be lost. However, the price of copper continues to rise.

Tin remains stationary at 45 cents, which is excessively high. Comparatively speaking, tin has been quiet during the last week.

Spelter still sticks at 30 cents, which is a phenomenal price. It appears that there is plenty of ore in the mines in the United States but that the whole situation is controlled by the output of the refining plants. Hence the present scarcity.

Lead has gone up to 8 cents. No satisfactory reason can be given for this, but it is thought that the present large stocks are being manipulated.

The scarcity of antimony has caused the price to soar to 40 cents. It is impossible to obtain large quantities of this metal, and any slight increase in the demand sends the prices soaring.

Aluminum has moved up to 32 cents. It is supposed that an unexpected demand for use in aeroplanes and electric transmission lines has caused the sudden jump in price.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

COMING CONVENTIONS.

Associated Advertising Clubs of the World, Chicago.—June 20 to 24.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring Meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

Toronto, Ont., June 17, 1915.—There is practically no change to note in the industrial conditions, but an optimistic feeling is being maintained in business circles. This is due largely to the favorable crop reports and a belief that orders for war materials will continue to be placed with Canadian manufacturers. Business in ordinary lines continues slow and shows little prospect of any material improvement for some time. The activity in the shell industry is unabated and development is proceeding in a satisfactory manner. An interesting address was delivered here last week by General Bertram, Chairman of the Shell Committee, on the work done by this organization since its inception. The address revealed the important nature of the work and the rapid development that has taken place in the shell industry since last September when the first orders were placed. As the direct outcome of the work of the Shell Committee, a copper refining plant will be established in Canada which will be the first of its kind in this country.

The continued advance in the price of metals, particularly spelter and lead, has resulted in higher prices for a number of products in the manufacture of which these metals enter. The most important are galvanized sheets, black sheets, brass wood screws, lead wool, red lead, copper rivets, copper and lead scrap. Higher prices are announced for transmission rope and drilling cables, due to conditions in the manila market and increased freight rates.

Steel Market.

The demand for steel bars and billets for shells is increasing and the mills have all they can do to meet the requirements. In addition to the order for shells from the British Government, it is anticipated that the French and Russian Governments will also distribute orders for a large number of shells in Canada. There is also a considerable amount of steel being used for rifle barrels. It is reported that the Ross Rifle Co. of Quebec are turning out 6,000 rifles per month, and have been obliged to refuse a large order from the Russian Government. There is only light demand for merchant bars and structural shapes, the building trade being very dull. Notwithstanding conditions, prices are very firm.

Conditions in the galvanized sheet trade are very bad owing to the unprecedented high price of spelter, which precludes the possibility of making and selling galvanized sheets at a profit, or even at cost. The result is a further advance in sheets of 25c per cwt. Since this advance the spelter market has weakened and the situation will probably improve if lower prices are maintained. Black sheets have advanced 10c per cwt.

Pig Iron.

The market is still very dull and featureless with nothing of interest to report.

Scrap Metals.

The scrap metal market continues active and further advances in copper and lead have to be noted. This is accounted for by the strength of the copper and lead markets, the latter being particularly active. All varieties of copper scrap are ½c and lead ¾c per pound higher. Scrap zinc and brass are unchanged, but very firm, while iron and steel scrap is dull and stationary. Prices are given in the selected market quotations.

Machine Tools.

The situation in the machine tool market is unchanged. The difficulty of obtaining anything like satisfactory delivery is the chief trouble that dealers have to contend with. This uncertainty is to some extent affecting the placing of orders. A number of interesting inquiries have been received recently by local dealers, but the amount of business closed this week has not been very heavy on account of the conditions prevailing. The number of firms in the shell business continues to increase and the outlook in the machine tool trade is distinctly promising.

Supplies.

The demand for machine shop supplies continues good, due almost entirely to the shell business. A number of price changes are to be noted this week. Linseed oil and turpentine have declined 3c and 2c respectively due in both cases to weakness in the market. The sharp advance in pig lead has resulted in higher prices for red lead and lead wool, the former having advanced 2c and the latter 1c per pound.

Brass and bronze wood screws have advanced on account of the increased price of spelter, the new discounts being 75 and 70 per cent. respectively. The new discount on copper rivets is 20 per cent. as against 27 per cent. formerly. The unfavorable conditions in the Manila market and high freight rates have caused an advance of 1c in transmission rope and drilling cables. They are now quoted at 19½c and 17½c per pound respectively.

Metals.

With the exception of spelter, the markets are showing considerable strength. Tin, copper and lead have all advanced, the latter being very active on heavy demand, while the position of both tin and copper has improved. The spelter market is weak and declining. There has been a good movement in antimony and quotations are strong.

Tin.—The market has advanced in London, due to heavy demand with renewed interest in futures. The New York market is quiet, but the spot and June market is strong on account of small stocks and very little to arrive in the next two weeks. Local quotations have advanced 5c and are nominal at 45c per pound.

Copper.—Both London and New York markets are strong at advanced quotations. There is a heavy demand for copper and indications point to a further increase in consumption. The copper position is a strong one and higher prices are probable. Copper has advanced ½c per pound locally, and is quoted at 21½c per pound.

Spelter.—The market is very weak and a reaction has set in. There appears to be a general desire to sell and take profits, although there are no buyers. The market is probably being manipulated, as the demand continues heavy and supplies scarce. The British Government contemplate commandeering all stocks of spelter in Great Britain, and prohibiting the use of spelter for galvanizing except for government work, including what may be required for munitions. Local quotations have declined 2c, and are nominal at 28c per pound.

Lead.—The market continues to show considerable strength with higher quotations. The Trust appears to have control of the market and there is considerable speculation as regards developments. Lead has advanced 1½c locally and is being quoted at 8c per pound.

Antimony.—The market is very strong in New York and big business is being done both for future and spot deliveries. Practically the entire production is being used in the manufacture of munitions and the demand is likely to increase. Quotations are very firm and nominal at 40c per pound.

Aluminum.—The market is firm and unchanged at 24c per pound.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

CANADIAN EXPORTS to BRITAIN.

THE following are the official figures of trade between Canada and Great Britain in the undermentioned articles during April:

Imports From Canada.

	1915.	1914.
Wheat	£651,467	£388,132
Wheatmeal and flour	164,821	146,847
Barley	299	19,965
Oats	23,243	4,481
Bacon	318,745	71,225
Hams	28,355	14,666
Cheese	15,686	6,872
Canned salmon	118,993	132,510
Canned lobsters	12,830	4,057

Exports to Canada.

Spirits	27,213	75,626
Wool	43,795	12,464
Pig iron	6,828	4,483
Wrought rails	558	3,152
Galvanized sheets	4,389	55,361
Tinned plates	6,694	6,796
Steel bars	5,003	16,247
Pig lead	815	5,314
Cutlery	5,330	5,364
Hardware	3,660	9,483

Trade Gossip

Women Make Shells.—Women are playing an increasingly important part in supplying the huge demands of the British Army for shells. At the Vickers Sons & Maxim Works, Barrow-in-Furness, 600 women hands employed in the manufacture of munitions have given such satisfaction that the firm had decided immediately to employ an additional thousand. Other firms are expected to follow suit.

Toronto, Ont.—Hon. G. H. Ferguson, Minister of Lands, Forests and Mines, has decided to offer by tender the disposal of another large pulpwood limit near Lac Seul, north of the Transcontinental Railway. The limit comprises 2,500 square miles. Under the terms of the concession the successful tenderer will be required to construct a pulp and paper mill and spend $1,750,000 on mill and equipment. The capacity of the mill must be 100 tons of paper per day, and it must employ an average of 250 men for ten months in the year.

The Turbine Equipment Co., Toronto, has been awarded the following con-

tracts:—One De Laval $2\frac{1}{2}$-million gallon motor-driven pump, for the Brockville, Ont., filtration plant; two De Laval 175 h.p. multi-stage motor-driven centrifugal pumps, each to have a capacity of 1,200 Imperial gallons per minute against 315 ft. total head, including all piping and erection, for the town of Orillia, Ont. These pumps will be direct connected to Canadian Crocker-Wheeler variable speed motors.

War Contracts Inquiry.—The inquiry to be conducted by Sir Charles Davidson into army contracts in Canada is to open this week. John Thompson, K.C., of Ottawa, has been selected as Government counsel to assist the commissioner in the probe. Mr. Thompson is a well-known member of the bar and a son of the late Sir John Thompson, former Prime Minister. The sitting to be held this week will be largely of a preliminary character. It is unlikely that further sittings will be held during the summer. In the meantime auditors will examine the records and documents in the department.

C.M.A. Elects Officers.—The following officers were elected at the recent annual meeting of the Canadian Manufacturers' Association, held in Toronto: President, K. H. Sherrard, Alaska Feather & Down Co., Montreal; first vice-president, Thos. Cantley, Nova Scotia Steel & Coal Co., New Glasgow; second vice-president, S. R. Parsons, The British American Oil Co., Toronto; treasurer, Geo. Booth, Booth-Coulter Copper & Brass Co., Toronto; auditors, Wilton C. Eddis & Sons, Toronto.

The Government statement is that the "military" (they mean legal) authorities never contemplated having to send away more than six divisions, and now there are six times that number of men abroad. Besides supplying stores and ammunition for this number, we are also supplying a good deal to our Allies, our output being at the rate of 19 to 1 as compared with last September. Recent actions such as Neuve Chapelle show that in attack it is necessary to use shells at a rate never before dreamed of. We should like to hear no more about what our "military" authorities contemplated, because it is clear enough now that their contemplations were entirely and foolishly wrong. All these arguments and comparisons evade the real question, which is—Are we doing all we possibly can to defeat the enemy?—Ex.

German Torpedoes.—According to the Rivista Marittima, the German cruisers and restroyers built since 1909 have five torpedoes of 5.50 mm. (21.654 in.) in calibre. They are said to be 5.20 m. (17 ft. 0 13-16 in.) in length, and to carry an explosive charge of 135 kg. (297.5 lb.) of trinitrotoluol.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Madoc, Ont.—P. H. Nayler will equip a machine shop here for making general repairs.

Picton, Ont.—The D. J. Barker foundry has been reopened under new management.

Elmira, Ont.—A. M. Bowman is in the market for rotary pumps and steam specialties.

Berlin, Ont.—The Canadian Consolidated Rubber Co. is in the market for new machinery.

Windsor, Ont.—The City Council has authorized the Police Commission to buy a pulmotor.

Vancouver, B.C.—The Heaps Engineering Co. are installing machinery for making shells.

Sarnia, Ont.—It is reported that the Mueller Mfg. Co. will enlarge their plant in the near future.

Montreal, Que.—The Canadian Tar Products Co. will build a boiler house, condenser house and still.

Aurora, Ont.—It is reported that three factories at this place will be equipped for making shells.

Sarnia, Ont.—Frank Goodwin & Co. has organized a company to manufacture a patent gas heater.

Milton, Ont.—It is reported that S. E. Brandon and Gordon Edwards have a contract for making shells.

Kingston, Ont.—The council will call tenders for a 300-k.w. alternating current generator. W W. Sands is clerk.

Chatham, Ont.—The Canadian Wolverine Co. have decided to rebuild their plant, which was recently destroyed by fire.

Windsor, Ont.—The Water Commission will call tenders shortly for a 160-h.p. boiler equipment. W. A. Hanrahan is secretary of the commission.

Chatham, Ont.—A movement is on foot to organize a company to rent the Defiance Ironworks and install machinery for making shrapnel shells.

Calgary, Alta.—The construction of a series of six dams and power houses is being considered by the Alberta Hydro-Electric Power Co. The consulting engineer is A. W. Ellson Fawkes, and the approximate cost, $2,000,000.

Montreal, Que.—Fire on June 9 practically destroyed the plant of the Valleyfield Ironworks Co., on Wellington Street. The damage is estimated at $10,000.

Picton, Ont.—Hepburn Bros., of this place, and J. C. Wilson Co., of Glenora, have received contracts for shells. Arrangements are being made to purchase the necessary machinery.

Cobourg, Ont.—It is reported that George Thompson, of Thompson & MacDonald, is negotiating with a Toronto syndicate with a view to establishing a plant here for making shells.

Welland, Ont.—Extensions have been started at the plant of the Canadian Billings & Spencer Co. The new building will be 80 feet long by 70 feet wide, and the cost is estimated at $30,000.

Ford, Ont.—Work on another new addition to the Ford Motor Co. at an estimated cost of $60,000, has been started. The new building will extend 45 feet out into the river and 700 feet parallel with the present factory. Wells & Gray are the architects and contractors.

Toronto, Ont.—It is reported that the interests connected with the Chevrolet Motor Co., of New York will in the very near future establish a plant at Toronto. The plant will have a capacity of 15,000 motor cars per annum, and Thomas Houghton has been engaged as production manager.

Edmonton, Alta.—Capitalized nominally at $50,000, a company has been incorporated to carry on the business of manufacturing ammunition, explosives and gunpowder in Edmonton. It is stated that the company will take over the contract for $50,000 worth of shells, which was tendered to the Edmonton Iron Works several weeks ago.

Electrical

Hamilton, Ont.—Engineer Sifton recommends that three transformers be purchased, each having a capacity of 1,500 k.w.

The Halifax Electric Tramway Co. has just placed an order with the Nova Scotia Car Works for six passenger tram cars for the city service.

Orillia, Ont.—The Power, Light and Waterworks Commission has entered into a contract with the Standard Chemical Co., of Longford, to supply the latter with 200 horse-power at a rate of $34 per horse-power per year, for a period of five years. The cost of the necessary pole line, transformers and other equipment is estimated at $11,000.

Municipal

Yarmouth, N.S.—The town council will purchase a quantity of 12-in. cast iron pipe.

Ingersoll, Ont.—The council contemplate an expenditure of $10,000 on waterworks improvements.

Ailsa Craig, Ont.—The town council propose spending $7,750 on a Hydro-Electric distribution system.

Preston, Ont.—A by-law will be voted on by the ratepayers on June 21, to authorize a loan of $25,000 to the Hurlbut Shoe Co.

Woodstock, N.B.—The town council are considering the question of improving the water supply. Engineer Barbour, of Boston, Mass., will prepare a report.

Beauceville, Que.—The council are considering installing waterworks and lighting systems at an estimated cost of $85,000. J. Mignault, of Sherbrooke, Que., is the engineer.

Paris, Ont.—Voting on the by-law to grant $10,000 to Charles E. Wheeler & Son, needle manufacturers, for an extension to their present premises carried almost unanimously, the vote being 302 for and 38 against.

Owen Sound, Ont.—The council is considering the advisability of submitting a by-law to the ratepayers to authorize the town to issue $300,000 debentures to cover the cost of constructing a modern concrete elevator of one million bushels capacity.

Sarnia, Ont.—In accordance with a petition largely signed by ratepayers of the city, County Judge MacWatt last Monday began an investigation into the building of the new $250,000 waterworks plant, which is located on the lake shore above the city. The plant has so far proved a failure.

General Industrial

New Westminster, B.C.—The Liverpool Canning Co. will build a cannery.

Toronto, Ont.—An explosion of an acetylene gas tank on the railway siding did about $2,000 damage to the Gurney Foundry Co.'s building at West Toronto.

Strathroy, Ont.—The town council have decided to sell the old Caradoc Street School to George Rivers for a site for a basket factory. Mr. Rivers will commence work on the property at once.

Madoc, Ont.—Brown, Robinson & Co., of Toronto, will establish a whitewear factory here. The council will be asked to grant the company a bonus of $2,000.

Building Notes

Hamilton, Ont.—The T. Eaton Co. of Toronto has purchased a site here and will build a factory 75 ft. by 175 ft., and four storeys high.

Transcona, Man.—G. G. Teeter, of Winnipeg, has been appointed architect of the Transcona School Board, and the plans which he had prepared for a new school some time ago have been accepted. The new building will cost in the neighborhood of $28,000.

Toronto, Ont.—The Advisory Industrial Committee of the Board of Education will receive tenders up to Tuesday, June 22, 1915, for iron fence, to be erected around the grounds of the new Central Technical School, Lippincott Street. Plans and specifications may be seen at the office of the architects, Messrs. Ross & Macdonald, 908 Royal Bank Building.

Tenders

Bassano, Alta.—J. B. R. Bond, town clerk, will receive bids until June 19 for the supply of one 750-gal. turbine waterworks pump.

Moncton, N.B.—The I. C. R. is calling tenders for twenty large freight and passenger locomotives, and also a thousand standard steel frame box cars.

Toronto, Ont.—Tenders for all trades required for floors, etc., at High Level Pumping Station, will be received up to Tuesday, June 22nd, 1915. Specifications and forms of tender may be obtained at the City Architect's Department, City Hall.

Stratford, Ont.—Tenders for a 500,000 Imperial gallon elevated water tower will be received until Friday, June 25, 1915. Copies of the specifications and form of tender can be obtained from F. A. Gaby, chief engineer, Hydro-Electric Power Commission of Ontario.

Ottawa, Ont.—Tenders will be received up to July 1, 1915, for the manufacture, supply and erection of a 30-ton steam wharf crane, of the derricking jib type, for Halifax, N.S., dockyard. The specifications and conditions of contract may be seen at the office of the consulting naval engineer, Ottawa.

Railways—Bridges

Vancouver, B.C.—Tenders opened for the rebuilding of Connaught Bridge, which was partly burned a month ago, show that repairs will cost in the neighborhood of $125,000.

Hamilton, Ont.—It is understood that the Hamilton Bridge Co. engineers are busy preparing plans for a bridge across the Valley Inn Marsh, to be submitted as a solution of the difficulties facing the Toronto-Hamilton Highway Commission in connection with the new roadway across the marsh.

Brockville, Ont.—D. A. Stewart, A. V. Seaborn and A. P. Sturdy, of Ontario Hydro-Electric Commission Radial Railway Department have completed a survey and also secured much information in this vicinity bearing on a proposed electric railway from Toronto to Montreal and Ottawa. The work is practically completed for estimates of cost of construction and possible earning power.

Personal

J. W. Eber, the general manager of the Toronto, Hamilton and Buffalo Railway, has resigned that position because of ill-health.

Henry Hadley, Jr., city engineer of Verdun, Que., has sent his resignation to the council in order that he may qualify for a lieutenancy in the 5th Mounted Rifles.

M. L. Smith, B.A.Sc., of the editorial staff of Canadian Machinery and Manufacturing News, has been appointed Director of Engineering at the new Technical School, Toronto, Ont.

J. B. Fielding, F.L.S., F.Z.S., of Barrie, Ont., has been appointed by the Ontario Provincial Government as Consulting Fisheries Engineer and Fish Culturist. His duties commence at once.

W. P. Merrick, Dominion Government Harbor Engineer at Fort William, Ont., for many years, has been transferred at his own request to Windsor, Ont. His successor will be H. P. R. Craig, formerly District Government Engineer at Windsor.

Wood-Working

Ayer's Cliff, Ont.—Charles Robinson has erected a sash and door factory here and will install new machinery.

Pembroke, Ont.—Fire has destroyed the Pembroke Lumber Co. sash and door factory. The loss is estimated at $70,000.

Eburne, B.C.—The Wilton Shingle Co. mill has been totally destroyed by fire, with a loss of $10,000 on the building and plant.

Mount Brydges, Ont. — The Wallace Sawmill Co., whose mill wes recently destroyed by fire, contemplates rebuilding and purchasing new machinery.

Sherbrooke, Que.—The Canadian Box Mills Co. are negotiating with the Town Council with regard to the erection of a factory, estimated to cost $15,000.

Toronto, Ont.—It is reported that the Pedwell Lumber Co. has recently bought a lot adjoining the Belt Line at Hampstead Park, Fairbank, where they will erect a large factory and elevator, together with a lumber yard for the storage of coal and wood.

Refrigeration

St. Boniface, Man.—Raisig & Co. are contemplating the erection of an abattoir, at an estimated cost of $5,000.

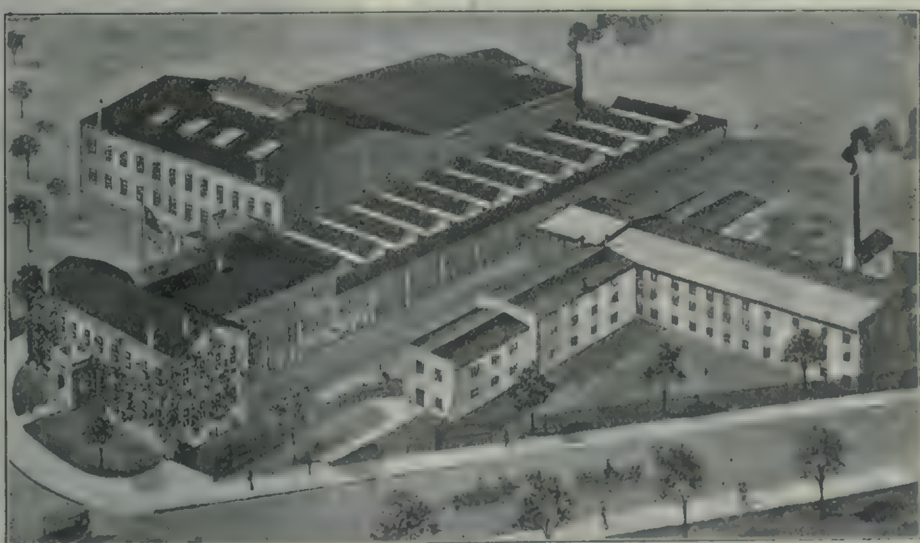
Estevan, Sask.—A. Harris, of this town, is interested in a proposed cold storage plant, which will probably cost $20,000.

Yorkton, Sask.—The Yorkton Creamery Co. is preparing to erect a larger building and install new, up-to-date machinery.

Halifax, N.S.—Heber Hartlen has submitted a proposition to the city to build a modern abattoir. The Board of Health have the matter under consideration.

Blow-off Valves.—The Engineering Specialties Co., Toronto, have issued a new catalogue covering the "Everlasting" Blow-off Valve and its services. A copy may be had by writing.

Charlottetown, P.E.I.—This city is to have another pork packing establishment in the near future, a company for that purpose now seeking incorporation



under the name of the Sims Packing Co., with a capitalization of $50,000. The incorporators are Messrs. R. E. Spillet, Samuel Kennedy and Daniel McGregor, all of Charlottetown.

Contracts Awarded

Goderich, Ont.—The Paget Grain Door Co. has obtained an order for 20,000 shell boxes.

New Incorporations

The Consolidated Motor Co., Vancouver, B.C., has been incorporated with a capital of $25,000, to manufacture motors, etc.

The Quatsino Copper Co. has been incorporated at Victoria, B.C., with a capital of $5,000,000, to develop mineral lands at Quatsino, B.C.

The Northern Electric Co., of Montreal, has been granted supplementary letters patent to manufacture shells, ammunition, howitzers and guns of all calibres.

MacKenzie Brothers, Ltd., Winnipeg, Man., has been incorporated with a capital of $100,000, to manufacture iron and steel products. John MacKenzie, W. J. Moran, Gordon MacKenzie are the incorporators.

The MacLaren Baking Powder Co. has been incorporated at Ottawa with a capital of $60,000 to manufacture baking powder, etc., at Toronto. Incorporators: Garnet Aikens Archibald and Charles Garfield French.

The Canadian Laundry Machinery Co. has been incorporated at Ottawa with a capital of $150,000 to manufacture laundry machinery at Toronto. Incorporators: Frank Adam Gaul and Bidwell Nichols Davis.

The Tupper Fire Escape Co. has been incorporated at Ottawa with a capital of $100,000 to manufacture fire escapes and safety appliances of all kinds at Sherbrooke, Que.: Incorporators, William Tupper, Carlos Albert Stokes.

The Adanac Silver Mines, Limited, has been incorporated at Toronto with a capital of $2,500,000 to develop mining properties. Head office at Toronto, Ont. Incorporators: John Alexander Donovan and Duncan McArthur, of Toronto.

The F. R. Wilford & Co. has been incorporated at Ottawa, with a capital of $50,000, to carry on the business of contractors and machinists at Lindsay, Ont. Incorporators—Frederick R. Wilford and Gerald H. Hopkins, of Lindsay, Ont.

The Pitts Construction Co. has been incorporated at Ottawa with a capital of $50,000 to carry on the business of an engineering and construction company at Ottawa. Incorporators: Herman Henry Pitts, Gordon McLead Pitts, of Ottawa, Ont.

The Cobourg Steel Co. has been incorporated at Toronto, with a capital stock of $40,000, to manufacture articles from iron, steel, etc. The provisional directors are Robert D. Hume, William J. Elliott, Joseph J. Greenan, all of Toronto, Ont.

The Cluff Ammunition Co. has been incorporated at Toronto, with a capital stock of $100,000, to manufacture ammunition, shells, etc. The incorporators are—Arthur W. Holmsted, Arthur B. Mortimer, Henry C. Draper, all of Toronto, Ont.

The Aetna Chemical Co., of Canada, Ltd., has been incorporated at Ottawa with a capital of $1,800,000 to manufacture guncotton, cordite, lyddite, nitroglycerine, etc., at Montreal: Incorporators, Orick Burroughs MacCallum, James Louis Finlay.

The Walpole Rubber Co. of Canada, Ltd., has been incorporated at Ottawa with a capital of $100,000 to manufacture rubber boots and shoes at Montreal, Que. Incorporators: Alexandre Chase-Casgrain, Errol Malcolm McDougall, of Montreal.

The Burlington Rapid Transit & Motor Mfg. Co., Ltd., has been incorporated at Ottawa with a capital of $50,000, to manufacture automobiles, motor cars, motor trucks, etc., at Hamilton, Ont.: Incorporators, Harold James Petrie, Thomas Halford Crerar.

The Dominion Mines & Quarries, Ltd., has been incorporated at Ottawa with a capital of $500,000, to carry on the business of mining, quarrying, concentrating, smelting, etc., at Toronto, Ont.: Incorporators, James Broadbent Taylor, Archibald Woodburn Langmuir.

The Canada Needle and Fishing Tackle Co. has been incorporated at Ottawa with a capital of $50,000 to manufacture needles, pins, hooks and eyes, etc. Head office at Toronto, Ont. Incorporators: Ernest Harold Day and Arthur John Crook, of Toronto.

The Acason Motor Truck Co., Ltd., has been incorporated at Toronto with a capital of $40,000 to manufacture all kinds of motor vehicles and accessories. Head office at Walkerville, Ont. Incorporators: Herbert Whalley Acason and Wilson Critzer, of Detroit, Mich.

The St. Lawrence Machinery, Ltd., has been incorporated at Ottawa with a capital of $50,000, to carry on the business of machinists, mechanical and electrical engineers at Montreal, Que. Incorporators—Clarence Francis Smith and Edmund Edwin Cummings, of Montreal.

The North American Magnesite Co. has been incorporated at Ottawa with a capital of $200,000 to prospect and refine magnesite, graphite and other minerals. Head office at Montreal, Que. Incorporators: Henry Noel Chauvin, Harold Earle Walker, James McDonald, of Montreal.

Marine

Kingston, Ont.—The steamer Turbinia is in drydock, and will undergo repairs before leaving for trade on the coast.

Quebec, Que.—The Department of Public Works, Ottawa, contemplate improving the St. Lawrence dock frontage of the Transcontinental Railway at an estimated cost of $500,000. Secretary, R. C. Desrochers, Ottawa.

Princess Royal in Commission.—The C. P. steamer Princess Royal, Capt. Locke, whch for the past five months has been out of service in consequence of the accident which befell her in Sabine Channel, has been called into commission again and is now being run on the night service between Victoria and Vancouver.

St. John's, Nfld.—The steamship Neptune has been chartered by a New York moving picture concern to make a trip round the world on their behalf. The voyage is expected to last two years. This vessel is amongst the oldest of the wooden members of the sealing fleet, and in her day was very successful, to her credit being due the landing in one trip of the largest number of seals recorded in history. She has also been engaged in a North Pole expedition, as a supply ship.

Halifax, N.S.—The stranded Plant Liner A. W. Perry, which went ashore near Chebucto Head on June 8 while on a voyage from Boston to Halifax, slipped off the rock upon which it had been resting and sank in six fathoms of water the following afternoon. Captain Ellis and the crew of the ship, who remained on board after the passengers had been removed, to superintend the attempts to take the ship off, had only left five minutes previous to her disappearance.

MACHINE TOOLS FOR IMMEDIATE SHIPMENT

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SHAPERS
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HAND TURRET AND SCREW MACHINES
AUTOMATIC TURRET AND SCREW MACHINES
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MISCELLANEOUS

WHICH DO YOU NEED?

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Montreal Vessel Torpedoed.—Cardiff, Wales. — The steamer Morwenna of Montreal was torpedoed, shelled and sunk by a German submarine at midday of Wednesday, May 26, at a point 160 miles west by south of St. Anne's Head. One member of the crew of the vessel was killed, while three others were injured. The survivors were landed at Cardiff, Wales. The Morwenna was bound from Cardiff for Sydney, Cape Breton, in ballast. The Belgian trawler Jacqueline picked up the crew. The Morwenna was a steel steamer of 1,414 tons gross, owned by the St. Lawrence Shipping Co., and under British registry from the port of Montreal. She was built in 1904 at Dundee, Scotland.

British Merchant-Ship Building.—The diminution in the amount of merchant ship work actually proceeding in British shipbuilding yards continues, and indeed a stage has now been reached when it is hardly an exaggeration to say that the construction of mercantile vessels has almost ceased there, notwithstanding the obvious need, referred to recently by the Chancellor of the Exchequer, of maintaining the mercantile fleet for the purpose of carrying overseas the national supplies of foodstuffs and raw materials. Naturally, such an extraordinary state of affairs cannot long continue, but at the present moment so pressing is the need for all energies to be concentrated on the building and completion of war and subsidiary vessels for the Government, the claims of all other classes of work in the shipyards are receiving but scant attention.

New Dock Opening.—In the presence of nearly 2,000 persons, among them three hundred members of the Board of Trade, the new Government dock at the foot of Church street, Windsor, Ont., the construction of which was commenced last year, was formally placed in service on May 27. It was expected that Hon. Mr. Hazen, Minister of Marine and Fisheries, would have been present to officiate at the ceremonies, but owing to illness he was unable to come, and Oliver J. Wilcox, M.P., took his place. At the luncheon served under the auspices of the Board of Trade, addresses were made by Mr. Wilcox, W. C. Kennedy; Dr. J. O. Reaume, Collector of Customs; Dr. J. A. Smith, and others. The new dock, which is the best appointed along the Detroit River, cost $65,000, and was built entirely under the supervision of Lieut.-Col. H. J. Lamb of the Public Works Department. It is of concrete throughout, is 655 feet in length and can accommodate the largest boats on the Great Lakes. Upon it is erected a large warehouse of fireproof construction, 300 feet long, with offices for the officials. The river has been dredged to give twenty feet of water at the dock. Jas. A. Reid has been appointed as custodian of the dock and he will assume his duties at once.

Trade Gossip

Quebec, Que.—It is announced that the properties of the Dorchester Electric Co. will be sold by auction on June 30.

The B. & S. H. Thompson Co. have removed their Montreal office from the Transportation Building to the McGill Building.

Vancouver, B.C.—The Sabulite Company of Canada, Ltd., has received large orders for bombs and grenades for the British Government.

The Canada Grip-Nut Co. have removed their Montreal offices from the Eastern Townships Bank Building to the McGill Building, McGill Street.

St. John, N.B.—A syndicate of Toronto capitalists has taken over manganese rights in Jordan Mountain district, and will have the same explored this summer. The Markhamville manganese areas are also to be developed at any early date.

Students to Work on Shell Tools.—The applied science department of McGill University, Montreal, has turned over its mechanical equipment for the manufacture of shell tools, and every student of this department has promised to devote his time exclusively to the work. It is expected that other Canadian universities will follow McGill's example.

Toronto, Ont.—The Turbine Equipment Co. have made a claim on the city for $2,080 as war tax on a pump for the main pumping station. They assert that it was owing to the city that the pump was not delivered before the war tax was imposed. The Works Commissioner reported that the city is liable for the amount, but the Mayor stated that he did not agree with the Commissioner's opinion.

Big Copper Exports.—Thus far in 1915 American exports of copper to Europe have been approximately 120,000 tons, against 180,000 tons in the corresponding five months of 1914, when the world was at peace and industry in Europe was flourishing. In spite of the contrast between conditions ruling now and then, Europe is buying copper at a rate equal to 70 per cent. of its 1914 purchases, and is steadily bidding for more of the metal. That is why copper stocks are so strong.

Calgary, Alta.—One of the largest industrial mergers of recent years in the West was consummated on June 10, with the merging of the Western Foundry and Metal Co., Ltd., and the Canadian Equipment and Supply Co., both of Calgary, and the International Supply Co., Ltd., of Medicine Hat, into the Canadian Western Foundry and Supply Co., Ltd., capitalized at $1,000,000, with head offices in this city.

Catalogues

Arc Welding Apparatus is the subject of Bulletin No. 48,905 being distributed by the Canadian General Electric Co., Toronto, Ont. The bulletin, which describes fully both stationary and portable outfits relative to construction and operation, is fully illustrated, and includes diagrams, with a table giving the principal dimensions.

The Dwight Slate Marking Machine is the feature in a catalogue being distributed by the Noble & Westbrook Mfg. Co., Hartford, Conn. Other matter deals with steel die cutting and dies, while a few samples of engraved work are also given, showing the wide scope of this machine. The catalogue concludes with a list of concerns using these machines.

Automatic Starters for alternating current motors are dealt with in Bulletin No. 48,405 being distributed by the Canadian General Electric Co., Toronto. Various types of automatic starters to suit the wide application of alternating current motors for industrial work are illustrated and described. A number of dimensioned diagrams and tables of automatic compensators, self-starters and float switches are also included.

Economy Cold Sawing is the title of a new catalogue dealing with the Lea-Simplex cold cutting-off saws, made by the Earle Gear & Machine Co., Philadelphia, Pa. The principal features of these saws are explained and details of construction described fully, accompanied by a number of very clear illustrations and diagrams. Specifications are included covering the various sizes, according to capacity. The catalogue concludes with a list of users of "Lea-Simplex" saws.

Monarch Furnaces.—A catalogue being distributed by the Monarch Engineering & Mfg. Co., Baltimore, Mo., features at length several types of furnace for mines, smelters, refiners, etc. Among those described are the double chamber, tilting, non-tilting and pit furnaces. Other descriptive matter deals with muffle furnaces, cyanide ovens, blowers, fuel oil burners, etc. A number of tables give the principal sizes and

general information covering the various types, all of which are illustrated.

Riveters.—Catalogue No. 3, fifth edition, 1915, deals with the various types of riveters made by the Hanna Engineering Works, Chicago, Ill. The principal features of the Hanna riveter are treated in detail, accompanied by illustrations and diagrams showing the construction and mechanical actions. The various types are illustrated, and, in addition, are included a series of interesting sectional drawings with the name of each part given. A number of tables give a list of sizes and code words, this being followed by a list of users. The concluding pages contain illustrations of various types of foundry equipment.

Book Reviews

The Progress of Warship Engineering, by C. de Grave Sells, M.I.C.E., is the title of a reprint from Janes' Fighting Ships, 1914, published by Sampson Low, Marston & Co., London, England. Price 2/6, 60c net. This is a most interesting publication and the accuracy of the information contained in its pages is unquestioned, having in mind the reputation of the author. The opening pages contain a description of the "Demologos," the first warship propelled by steam, and designed by Robert Fulton. The development during succeeding years is not touched upon until the advent of modern machinery, such as water-tube boilers, steam turbines, etc. In this section are described various types of steam turbines for war vessels with sectional views showing the general construction and details. This is followed by a description of several types of water-tube boilers, explaining their development and reasons for certain distinctive features embodied in their construction. Boiler economy and efficiency is next dealt with and includes descriptions of such apparatus as gas analysers, efficiency meters, calorimeters and recording instruments, etc. Considerable space is devoted to fuel oil and to the development of Diesel engines, while similar treatment is accorded air compressors and refrigeration plants. Other subjects dealt with include corrosion of boiler tubes, warship ventilation, ash dischargers, transmitters, etc. The booklet is carefully written and fully illustrated. It is both interesting and instructive, as it explains the progress that has been made during recent years in the propelling machinery and boiler plants of warships.

FOR SALE

FOR SALE—TWO OR THREE TOLEDO power presses from 2,000 to 5,000 lbs. in weight. Culp Specialty Co., Hamilton, Ont.

Utilization of Time Study Data in the Machine Shop*

By R. Thurston Kent**

In the introduction to his paper, the author makes reference to two ways in which time study data are generally procured, afterwards pointing out, that anything short of the elementary analysis of each individual type machine operations is not only crude and expensive, but sure to fail in its purpose of securing permanent and reliable production cost records.

THE object of time study is to determine the amount of work which a man can most efficiently perform in a day. Time studies can be taken in two ways. Each job that goes through the shop may have the watch held on it, and the over-all time of the job, or of its most important subdivisions noted. In the course of years there will accumulate a great number of records of jobs done, the time required for, and the methods used in each. These records will prove invaluable in setting rates and fixing minimum times for similar jobs as they recur from day to day. They are, when properly indexed and filed, a long step in advance of the earlier method whereby rates have been fixed "off the bat," as it were, by the foreman or rate setter, which rates are largely based on the judgment or guess of the individual who sets them.

Crude and Expensive Method.

Regarding wage payments and disputes, they present indisputable testimony that the rate is fair, for they represent the time and rate of some former workman who accomplished the job easily. They also enable the management to foretell with considerable accuracy how much any particular job is going to cost as regards the labor expended on it. Such a method of making time studies, however, is crude and expensive. It does not give that information most to be desired—aside from the length of time required for the job, as to the most efficient method of performance. It furthermore does not enable the fixing of an accurate rate on a new job unless it is quite similar to one which has been done before.

It is obvious that before a shop, doing even a routine line of work, can accumulate an amount of time study data, which will be useful, a long period, probably several years, must elapse, and the expense of obtaining these data will be out of all proportion to the benefits returned to the shop during the earlier portion, at least, of the period while the studies are being made.

Elemental Detail Method.

The second method of time study is that of analyzing all machine and work handling operations into the most elementary detail, separating such particular part of an operation into its smallest elements, and tabulating these elements together with their respective times. These elements are then grouped into appropriate classes and filed in such a manner that any element of any particular class can be readily found when desired. This being done, its is a comparatively easy matter to fix a time for a job which has never before been done in the shop, with the certainty that the time to set will be accurate, fair alike to employer and employee.

The method of consistent machine analysis will enable the manufacturer to accumulate in a comparatively short time an amount of time study data which will be applicable to a large portion of the work of his shop, and every addition to the data will widen the scope of his time study and rate setting department in an increasing degree.

This method of elementary anaylsis is logical, although at first sight it may not appear to be the easiest one. The natural tendency is for a manufacturer to obtain first a study of the time required for the most important job or the job that recurs oftenest in his establishment, and to then take up in their order the jobs of lesser importance. He feels that he is by this method making the biggest hole in shop inefficiency. He may, and probably will, get quicker results on that particular job but he is far from making as big a hole as he would were he to adopt the other method.

Complexity of Machine Tool Building.

The building of a machine tool is a rather complex proposition requiring the machining and assembling of a great variety of different pieces of varying shapes and degrees of finish. Nevertheless, every one of these many parts can be resolved into a comparatively small number of machine operations. In general, machine work can be divided into the turning of cylindrical surfaces, the planing or milling of flat surfaces and the drilling and boring of holes. Every piece that enters into a machine tool is a combination of these various surfaces. This gives us our first subdivision of our time study element. If we know the time required to turn a given cylinder of a known diameter, to plane or face the ends of it and to drill a hole through it, we have a means of ascertaining with fair accuracy just how long it will take to produce the piece in the machine shop. It is unnecessary to add, to the time required for performing these various machine operations, the time necessary to put it in the lathe, planer or drill press and to remove it from these machines. We, therefore, subdivide our time studies, first by the machines on which they are made.

Individual Machine Performance Subdivision.

Each machine should be studied in the greatest detail in order that the various operations which can be performed upon that machine may be combined with one another to represent the sequence which is to be followed in producing any given piece. This is not as large a job as it seems. Although almost any kind of machine work can be carried out in the ordinary engine lathe, the number of individual operations that a lathe will perform is comparatively limited. Thus the entire art of lathe work may be comprised in the following:

We may shift the belt from one cone to another; we may engage or disengage the back gears; we may change the feed gears; we may move the carriage along the ways; we may operate the cross-slide; we may set the compound rest; we may throw in or throw out the automatic feed operating either carriage or cross-slide; we may move the tail stock from one position on the ways to the next; we may set the tail-stock over one way or the other for the purpose of turning tapers, or if the machine has a taper attachment, we may connect the cross-slide to it or disconnect it; we may put on or remove a steady rest or follow rest; we may move the face plate and put on a chuck or vice versa; we may remove or replace head and tail centres; we may put in the tool post or remove from it one or another type of tool; we may start or stop the machine; we may engage or disengage the nut for screw cutting; we may advance or retreat the tail centre.

These fourteen operations represent practically everything that can be done with an engine lathe and yet the combination of these fourteen elements in varying sequences and numbers will enable us to perform pretty nearly any job of machine work which may be desired.

*From a paper read at the recent convention of the National Machine Tool Builders' Association Convention.

**Consulting Engineer and Scientific Management Specialist.

It is true that many jobs which could be done in the lathe can be done more efficiently in another type of machine, but the fact remains that, if we have only a lathe available, we can perform practically any job that comes into the machine shop by a combination of fourteen different types of machine movements.

It, therefore, becomes evident that by making an exhaustive study of all the lathes in a machine shop, that is, all the lathes which have different characteristics, we have accumulated an amount of data which will enable us to fix unit times for the performance of all the jobs which it is possible to do in the lathes in that shop. This is the method advocated for making time study by those who have spent the greatest amount of time at this work. In similar manner, the operation of a planer, of a shaper, of a drilling machine, of a slotter, of a boring mill, of a milling machine or of any other machine tool can be resolved into a comparatively small number of machine movements, which can be studied as to the time required for each, and which can later be combined in any shape and sequence necessary for the performance of any job which may come to that machine.

It is obvious, therefore, that the method of analyzing a machine and its handling time, will be productive of real results in the shape of accumulated data more quickly than will any other method of time study. It is true that the machine operations must be analyzed and studied completely before the data can be used. A partial study will be of but little value in setting a general run of tasks, for in all probability the particular machine item which may be needed in setting the task on a given job will be the one on which no time study has been made. The complete study of a large number of machines does not require such a great amount of time as might be imagined.

Different Machine Operations Subdivision.

We have seen how time study data should first be subdivided according to machines and then according to machine operations. We will go into this detail a little more closely at this time to illustrate how finely the different machine operations should be subdivided before they are tabulated for re-combination into elements forming complete jobs in the shop. One of the commonest operations which occurs in lathe work is the placing of the cutting tool in the tool post prior to cutting metal and the removal of it from the post upon the completion of the machine operation. The time given in studies on lathe work made by Mr. Merrick for putting an ordinary three-quarter inch turning tool in the tool post of a twenty-four inch lathe is 0.30 minute. This time is made up as follows:

	Min.
Get tool from tray at end of lathe	0.03
Measure height of tool	0.06
Put packing in tool post	0.07
Set tool in position	0.03
Tighten tool post set screw	0.08
Total	0.30

The time for removing the tool from the post is tabulated as follows:

	Min.
Loosen tool post set-screw	0.03
Remove tool to tray at end of lathe	0.05
Total	0.08

If it be necessary to change from one tool to another during the course of the machine work, we have in the same tabulation an item entitled "changing tool." This is made up as shown below:

	Min.
Remove tool (as above)	0.08
Put in new tool (as above)	0.30
Total	0.38

In the same tabulation, we find one more item, "Set tool for bearing, 0.17 min." This item refers to the setting of a square-nose finishing tool to bring it square with the surface of the work and is to be added to the time required for setting the tool in the post. Thus, if we had to set in the tool post a square-nosed finishing tool, the analysis of the operation would appear as in the first table with the additional item, "Set tool for bearing" added, and the total time would be 0.47 min. instead of 0.30 min.

Instruction Card Feature.

While the operation of tool handling is analyzed in the detail explained above, it is in practice put on the instructions issued to the men in the form shown. The total time only for the entire operation of tool setting will be given appearing on the instruction card as as item, "set tool in post, 0.30 min." The value, however, of the detailed analysis is that if the time, 0.30 min., is ever questioned as being too long or too short, we have available the elements which enter into the making up of this time and can easily ascertain in which particular part of the study the workman or the time study man was at fault.

This is not a particularly good example, however, of this advantage, as the time 0.30 min. is not liable to be questioned unless it is one that recurs quite frequently. In any case, the principle remains the same whatever the operation may be. There are many jobs the individual operations of which occupy many minutes, and if these operations are questioned the detailed analysis is always available to show what the workman is expected to do and how long each element should require. If a workman can not complete his job in the time fixed, a comparison of his work with the detailed analysis—the watch being held while the comparison is made—will frequently show that he is exceeding the analysis time in one particular element only and that a correction of his work as regards this element will often bring his performance well within the time called for by the time study.

Individual Elements Combination.

Returning to a consideration of the combination of individual elements for the making up of a unit time for a job. In the first table which we cited, that giving the time for putting an ordinary turning tool in the tool post, we had a list of all the elements common to any tool. In establishing unit times for handling different types of tool than the ordinary round nose turning tool, we have only to add to the elements for that tool those items which are different in the tool under consideration. We have already seen what change is made in the analysis for a square nose tool. For a chamfering tool or a facing tool, we have only to add to the analysis for the turning tool the item of setting the tool to a bearing. For a thread tool we have to add the additional item, "set tool to thread gauge." Thus, in determining unit time for handling any type of tool in the lathe, we can simplify both the time study and the tabulation by first studying the handling of that tool which contains all the elements which the other tools require, and then studying those particular elements which are different in the remaining tools.

After having determined a series of elements of various character, such as the putting of the tool in the tool post, these elements can be combined with others similarly determined to form complete fundamental operations which enter into the completion of a definite job. Such a fundamental operation is the setting and starting of a cut. In the compilation of time study data with which the writer has been working for a number of months past, the setting and starting of cuts in a great many different sizes of lathes, and with practically every variety of cutting tool are tabulated in a manner similar to the following. This tabulation is for the setting and starting of a cut with a round nose, rough turning tool in a 24-inch lathe:

	Min.
Put tool in post and tighten	0.30
Start machine	0.03
Set calipers	0.35
Set cut by eye or calipers	0.20
Put feed in	0.03
Total	0.91

In writing up the instruction card, this item would be listed simply as "set and start cut, PRB ¾-in. tool—0.91 min." After the cut has been completed, if the tool is to be removed, the following items are taken together from

the analysis to give the time for stopping the cut and removing the tool.

	Min.
Throw feed out	0.03
Run tool half way back	0.05
Run carriage back	0.05
Stop machine	0.10
Loosen and remove tool	0.08
Total	0.31

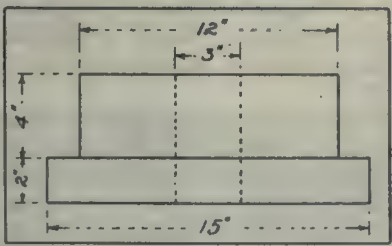
On the instruction card this item would appear simply as "stop machine, remove tool—0.31 min." If, however, the tool were to be run back to the beginning of the cut and an additional cut taken, we would use another set of items appearing in the same tabulation, as follows:

	Min.
Set cut by eye or calipers	0.20
Put feed in	0.03
Throw feed out	0.03
Run tool half way back	0.05
Run carriage back	0.05
Total	0.36

It will be observed that in this tabulation the same items appear as in the former ones, except that they are grouped slightly different, and the items of removing the tool and stopping the machine are omitted, as these operations are not performed when repeating a cut without removing the tool from the tool post. These tables are a fine example of how elementary time study enables one to build up unit times for different operations. Having the data necessary to fix a time for setting and starting a cut analyzed in the detail exhibited in the first two tables above, it is unnecessary to make a study of the time required for an additional cut. The man familiar with machine work can list without any trouble just what motions the lathe hand goes through in running his tool back and restarting the cut. These are as given in the table above. Having the time for these various items exhibited in the earlier tables, it is only necessary for him to set them opposite the items in the new table and total them, and he has the proper unit time for making an additional cut with the same tool.

Examples could be multiplied indefinitely to show how the various elements are combined and built up to form larger and larger fundamental operations until we have a total time for a complete job. The above, however, is probably sufficient to indicate the principle involved, and those interested can pursue the study as far as they care to do so.

Typical Instruction Card



Material: Cast iron.
Weight: 200 pounds.
Finish all over.

		Preparation.	Handling work.	Handling tools.	Handling machine.	Removing metal.
(1)	Remove face plate from lathe	0.49	....	....	....	....
(2)	Put chuck on lathe—use hoist	2.08	....	....	....	....
(3)	Move tail stock back	....	....	....	0.28	....
(4)	Land piece in chuck, gripping large dia.	....	2.53	....	....	....
(5)	True piece in chuck	....	2.03	....	....	....
(6)	Put rough turning tool in post	....	....	0.30	....	....
(7)	Change feed and speed	....	....	....	0.50	....
(8)	Set calipers	0.35	....	....	....	....
(9)	Set and start cut	....	....	....	0.23	....
(10)	Rough turn on small diam	....	....	....	....	2.75
(11)	Stop machine, run tool post back	....	....	....	0.15	....
(12)	Change to rough facing tool	....	....	0.38	....	....
(13)	Set and start cut	....	....	....	0.34	....
(14)	Rough face flange	....	....	....	....	1.25
(15)	Move carriage to end of piece, set and start cut	....	....	....	0.43	....
(16)	Rough face small end	....	....	....	....	3.25
(17)	Stop machine, run tool post back	....	....	....	0.10	....
(18)	Change to finish turning tool	....	....	0.38	....	....
(19)	Set and start cut	....	....	....	0.43	....
(20)	Finish turn small diam	....	....	....	....	2.75
(21)	Stop machine, run tool post back	....	....	....	0.10	....
(22)	Change to finish facing tool	....	....	0.38	....	....
(23)	Set and start cut	....	....	....	0.47	....
(24)	Finish face flange	....	....	....	....	1.25
(25)	Move carriage to end of work	....	....	....	0.10	....
(26)	Set and start cut	....	....	....	0.28	....
(27)	Finish face end of piece	....	....	....	....	3.25
(28)	Stop machine, move carriage back	....	....	....	0.10	....
(29)	Change to rough boring tool	....	....	0.38	....	....
(30)	Set and start cut	....	....	....	0.36	....
(31)	Rough bore hole	....	....	....	....	4.00
(32)	Run carriage back, change to finish tool	....	....	0.67	....	....
(33)	Set and start cut	....	....	....	0.36	....
(34)	Finish bore	....	....	....	....	4.00
(35)	Run car'ge back, stop mch., remove tool	....	....	0.23	....	....
(36)	Turn piece end for end in chuck	....	3.13	....	....	....
(37)	True piece in chuck	....	2.03	....	....	....
(38)	Run carriage up	....	....	....	0.05	....
(39)	Put rough turning tool in post	....	....	0.30	....	....
(40)	Set and start cut	....	....	....	0.23	....
(41)	Rough turn edge of flange	....	....	....	....	1.75
(42)	Run carriage back	....	....	....	0.05	....
(43)	Change to finish turning tool	....	....	0.38	....	....
(44)	Set and start cut	....	....	....	0.43	....
(45)	Finish turn flange	....	....	....	....	1.75
(46)	Stop mach., change to rough facing tool	....	....	0.38	....	....
(47)	Set and start cut	....	....	....	0.34	....
(48)	Rough face flange	....	....	....	....	4.00
(49)	Run tool post back, stop machine	....	....	....	0.05	....
(50)	Change to finish facing tool	....	....	0.38	....	....
(51)	Set and start cut	....	....	....	0.47	....
(52)	Finish face flange	....	....	....	....	4.00
(53)	Stop mch., run carriage back, rem. tool.	....	....	0.13	....	....
(54)	Remove piece from chuck to floor	....	1.49	....	....	....
(55)	Remove chuck	1.59	....	....	....	....
(56)	Replace face plate	0.88	....	....	....	....
(57)	Clean machine	2.00	....	....	....	....
	Preparation time	7.39	....	....	....	....
	Handling work	....	11.21	....	....	....
	Handling tools	....	....	4.29	....	....
	Handling machine	....	....	....	5.85	....
	Removing metal	....	....	....	....	34.00
	Total time for job	....	....	....	....	62.74

Preparing Instruction Card for Lathe Work.

We will now take up a concrete illustration of the application of the principles of elementary time study to the preparation of an instruction card for a job of lathe work. The instruction card, which is shown in this connection, is modified in form in order that the different classes of elementary times may be separated for purposes of illustration. In all time study we divide the work into general classes of preparation time—that is, the time necessary to prepare the machine for receiving the work and for restoring it to its standard condition after the job is done; the handling time of the work itself—that is, the time required to place the work in the machine, remove it, and perform any manipulations which are necessary to put it in place for machining. This includes hoisting and landing it in the machine, chucking, truing, leveling, squaring and similar operations; tool handling time, that is, the manipulation of the cutting tools, putting them in the tool posts, removing them, etc.; machine handling time, which includes all machine manipulation, such as moving the carriage, changing speeds, setting and starting cuts and similar operations, machine time, which represents the time actually employed by the machine in removing metal.

The first four sets of times are determined by elementary time study, while the last set of times can best be determined by means of the slide rules devised by Mr. Barth. To use these slide rules, however, requires that the ma-

chines be standardized as to feeds, speeds and pulling power according to the rules formulated by him. Unless this standardization has been made, the machine time must be determined by other methods which are slower and more cumbrous.

Referring now to the instruction card shown, we see that it calls for the machining of a cast iron piece weighing about 200 lbs., which is to be finished all over and to have the hole in the centre bored. It is assumed that a roughing and finishing cut is to be taken for every operation and that different tools are to be used for turning and facing, this being in accordance with the practice of the shop from whose time studies this instruction card was written.

An inspection of the instruction card will show that the first operation is the removal of the face plate which normally remains on the machine and the replacement of it by a four-jaw independent chuck. A reference to a tabulation of times for handling face plates and chucks shows that 0.49 min. are required to remove the face plate and 2.08 min. to lift the chuck from the floor by means of a hoist and screw it upon the spindle of the lathe. Both of these items are in the tabulation sub-divided into their elementary details as explained earlier. Another tabulation shows that it requires approximately two and one-half minutes and two minutes respectively to land a 200-lb. piece of the approximate dimensions shown in the lathe chuck and to true it.

The sequence of operations followed in machining the work is clearly shown by the instruction card, including the turning of the work end for end in the chuck in order to turn and face the flange of the piece. It will be noted that although there are fifty-seven different items listed, the actual number of operations performed is considerably less than this. A study of the card will show that most of the operations, such as "set and start cut" recur from time to time. We have in item No. 6 our old friend, "put tool in post—0.30 min.," and in items Nos. 12, 18, 22, 29, 43, 46, 49, the combination of the items "put tool in post" and "remove tool from post." It will be recollected that the sum of these two items, as given earlier, was 0.38 min. We could in writing the instruction card, of course, have subdivided the items "change to rough facing tool," etc., as above, and have given the separate times of 0.30 min. and 0.08 min., but this would have accomplished nothing except to increase the length of the instruction card. The two items are, therefore, combined in one, as shown.

Referring next to item No. 9, "set and start cut 0.23 min.," this is made up of the items of setting the cut by calipers, starting the machine and throwing in the feed. We have the same time in item 40, which is a cut started under the same conditions as that represented by item No. 9. In item No. 13 we have a time of 0.34 min. for setting and starting cut. It will be observed, however, that this is a facing cut, and that there are some additional operations to be performed as compared to a simple turning cut. These include the tightening of the carriage nut after the cut is set and the loosening of it at the conclusion of the cut. In items Nos. 23 and 51, we see a still different time for the setting and starting of cuts. These, it will be observed, are "finish facing cuts," and it will be recollected that in the setting of a finishing tool there is the additional item "set tool for bearing" to be added to the time required for setting the ordinary roughing and facing tool.

Turning now to the totals of the several columns, it will be observed that 7.39 min. are required to prepare the machine for the work and to clean it up after the job is finished. The actual handling of the work consumes 11.21 min. The handling of the cutting tools requires 4.29 min., and machine manipulation accounts for 5.85 min. A total of 34 min. is required for the actual removal of metal, giving a grand total of 62.74 min. The fatigue allowance would bring the time for the job to about 75 min. The interesting thing about these tools is that the machine is working only a little over 50 per cent. of the time, if the fatigue allowance is not considered, and less than 50 per cent. if the allowance is taken into consideration. This points to two things:—(1)—The importance of studying closely the manipulation both of the machine and of the work. (2)—The value of time study in increasing the relative producing time of the machine. Let us consider these two items in order.

There is no doubt but what a man sitting at a desk carefully studying a drawing of a piece, such as is shown here, can plan out the sequence of operations in manufacturing it much better than the man at the machine, who must necessarily keep his attention on the work while the machine is in operation, and do his planning between cuts or do it all in advance of starting work. In either event the machine will be idle a greater length of time than is necessary. The man at the machine will have a tendency to consider each operation by itself and thus introduce more machine manipulations than are necessary.

For instance, the chances are that left to his own initiative the workman would introduce the finish turning cut immediately after the first rough turning cut, requiring an additional machine manipulation, as compared with the method laid down in the instruction card, which calls for the rough facing cut immediately after the rough turning cut, thus saving running the carriage back once. With the work planned out for him by a man preparing an instruction card showing the best method and the one requiring the least handling of tools and machine, the workman can keep his machine at the business of making chips for the greatest possible length of time, and it is only while it is making chips that a machine is making money for its owner.

Relative Producing Time of Machine.

The second item offered for our consideration is the value of time study in increasing the relative producing time of the machine. This has in part been covered above, but the particular feature in mind is that the handling time in machine work bears a much greater proportion to the total machine time than is commonly realized. It gets us little, if we standardize our machines so that we can use Mr. Barth's slide rules and thereby set speeds and feeds, which will reduce the time required in removing metal by 10 or 15 per cent. if we do not at the same time set an equally high standard for the necessary but unprofitable work from the standpoint of machine earning capacity of handling and manipulation. If we decrease the cutting time 10 per cent., but at the same time do not check the workman up on his handling time, so that he increases it 15 per cent. to be sure that he will not produce too much in a day and, therefore, suffer a cut in rate, we have actually lost money if the ratio of handling and machine time is about as was shown in the example just exhibited.

By itemizing the handling operations, as was done in the instruction card just shown, and by setting unit times which have been carefully determined by elementary time study, we have furnished a standard of performance to which we can hold the workman. The standard is not an unfair one, because it is determined by the performance of other workmen, and is a standard which, if the time study has been accurately made, is one which can easily be obtained by the ordinary good man. The mere fact that there is a standard by which the performance of the workman can be measured will in itself tend to increase the effort of the man to do his best. The standard being present, any failure to attain it can be investigated and the particular point wherein the man failed can be indicated to him, and his fault corrected. It has been found time and again that where this standard of performance has been omitted that the handling time in all machine work has gradually increased with a consequent decrease in the relative producing capacity of the machine.

PRODUCTION METHODS AND DEVICES

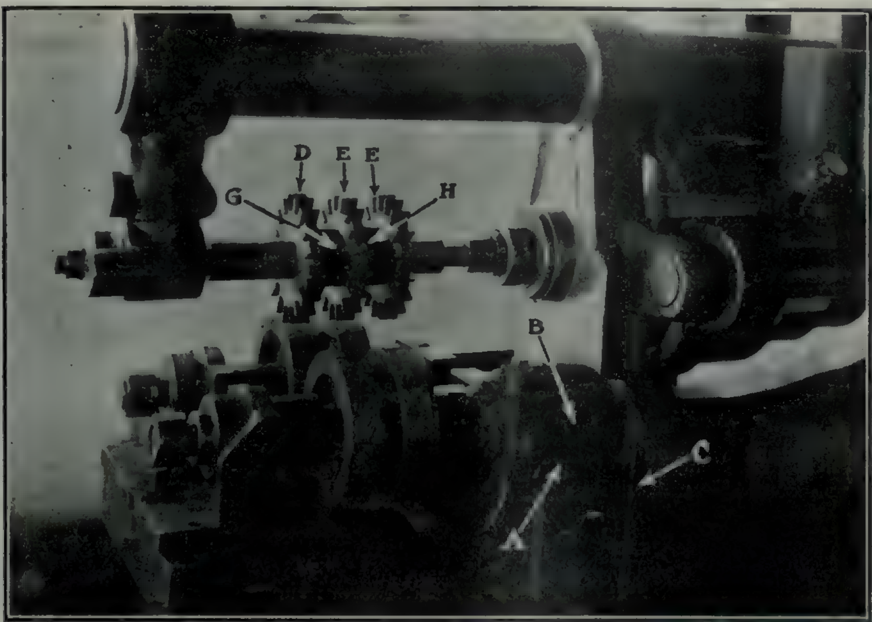
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

MILLING OUT GEAR BLANKS.

By A. E. Granville.

A RATHER unusual method of machining gear blanks is followed by an Eastern firm. The blanks are bored out and the ends of the hub faced. They are then placed, four at a time, in the fixture shown. The two spindles, by which the work mandrels are revolved, have worm gears in the fixture housing next to the milling machine column. These worm gears mesh with worms on the same shaft with worm gear A.

A worm B is driven from a sprocket and chain C, which gets its movement from a sprocket on the universal jointed feed shaft. As the gear blanks are slowly revolved, the table is raised, feeding the work to the gang of cutters on the milling machine arbor. The three side mills, D, E and E, finish the sides of the gear blank rims and the cutters G and H finish the outside diameters. As four blanks are milled at once, the method is a fairly rapid one.



MILLING OUT GEAR BLANKS.

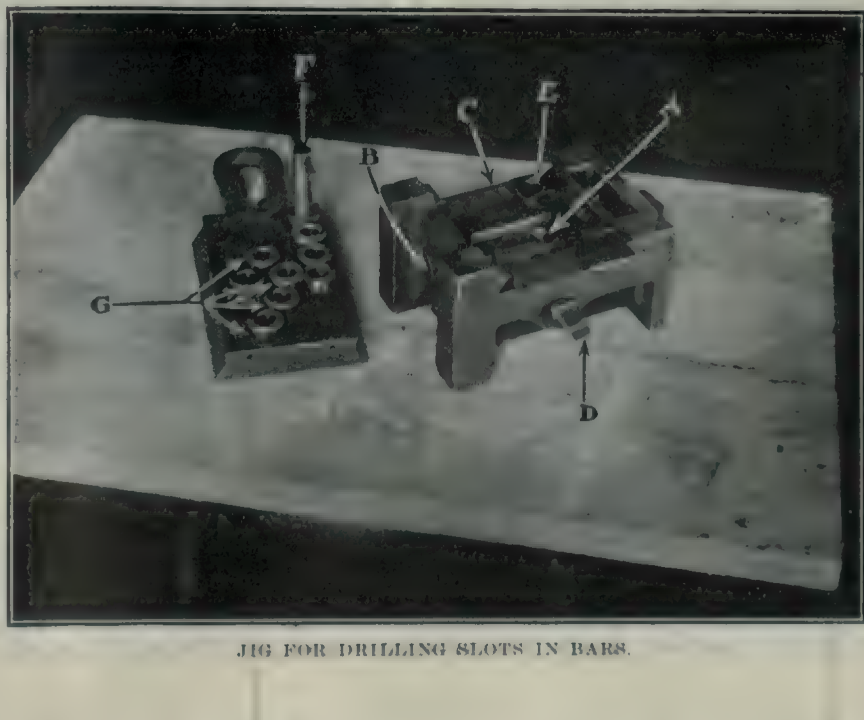
DRILLING SLOTS IN BARS.

By. E. Avery.

IN drilling holes in boring bars, tool posts and the like, it is often hard to drill out enough of the metal to make the hand-finishing job an easy one. A lot of the web left has often to be chiseled out, with the chance of making an ugly mess of it. Even when the slot is finished by milling, the chisel often has to be used first.

The jig shown is a very handy tool to have about the shop, if made sufficiently large to take in the average run of such work. A tool post, which has just been drilled out, is shown in place at A. This has been slipped in through the hole B, and is held against the V-block C by means of the heavy set screw D. There is a bushed hole at E into which the locating pin F may be thrust through any of the four bushed holes in the slide. The use of the pin in these holes locks the various drill bushings G in position over the work so that a practically continuous slot may be drilled.

The method of locating the drill bushings in this way gives plenty of room to use heavy bushings solidly set. A regular drill may be used for the end and middle holes of the slot if desired, but better results will be obtained if a drill ground more bluntly is used for the webs that are left. A comparatively small amount of filing is needed to finish the slot thus drilled.



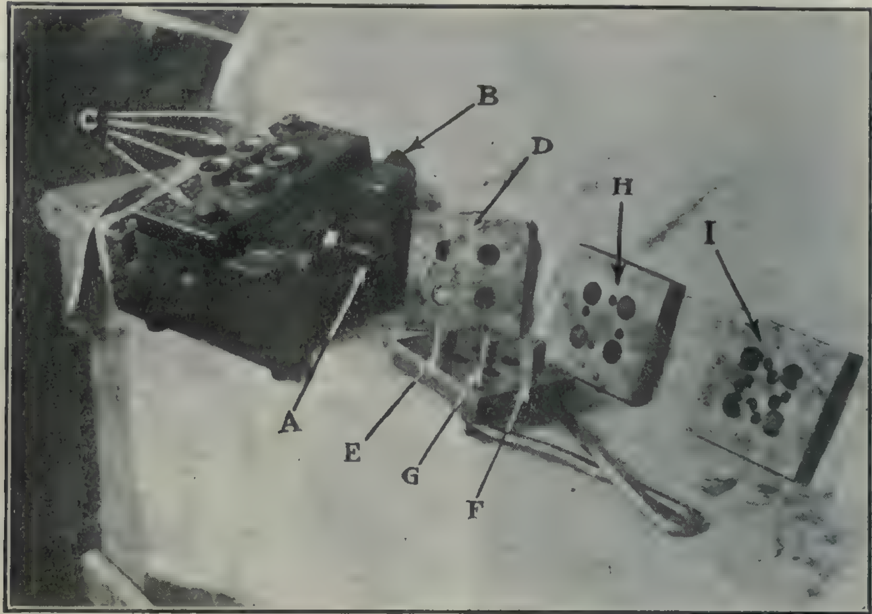
JIG FOR DRILLING SLOTS IN BARS.

DRILLING OUT SOLID THREADING DIES.

By G. Edwards.

WHERE pipe or other solid threading dies are made in the shop, and the threads are cut with a fine-fluted hob, the jigs shown will be found good for drilling out the superfluous stock. The blanks are first sawed from the bar, and are then placed in the jig shown at the left in the illustration. They are pushed in against the stop A, and are locked in with the set screw B. Four corner holes are then drilled through the bushings C, the result appearing as shown at D. The jig with the handle is then placed in the drilled blank, with the two pins E and F in diagonal holes. The pin G is a sliding one used as a knock-off. Four smaller holes are drilled with this jig, the blank then looking as shown at H. Another similar jig is used for the four

additional holes in I. The centre may now be broken out with a heavy punch and hammer. These jigs have the merit



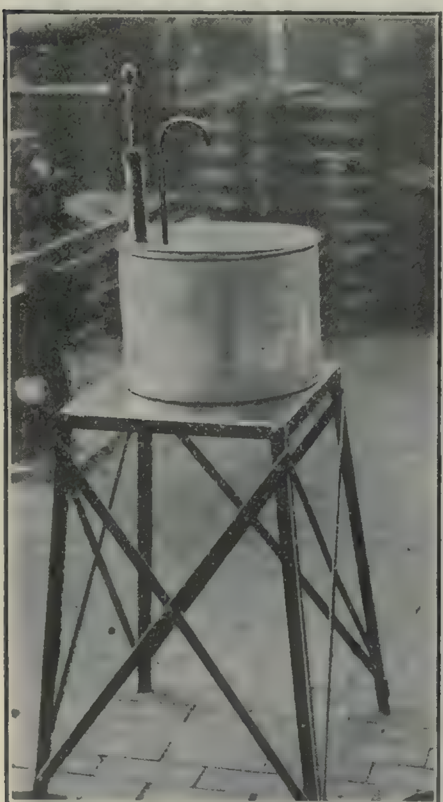
JIGS FOR DRILLING OUT SOLID DIES.

of being cheap and easy to make, as well as sufficiently accurate for all practical purposes.

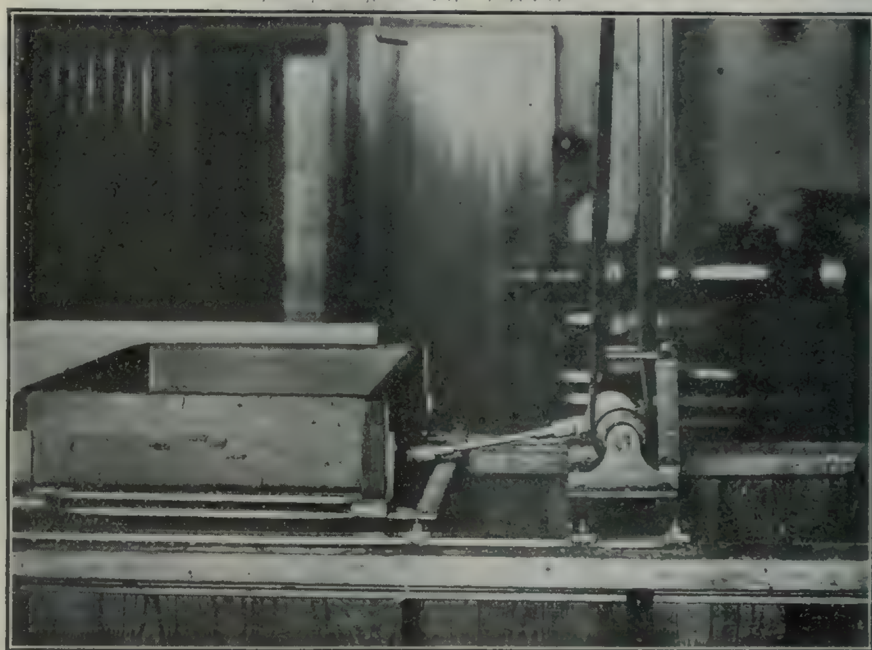
SAVING TIME IN GETTING OIL.

By E. Lock.

A WORKMAN often finds his oil can empty, and a boy to send to fill it nowhere to be seen. To offset such a contingency, the Macon, Ga., shops of the Central Railroad of Georgia uses the type of supply stand shown. These are placed at frequent intervals throughout the various departments, more, of course, in the machine shop. The top of the tank is hollowed-in, so that any surplus oil from an overfilled can will run back into the tank. The whole apparatus costs little to make, and is soon paid for in the saving of the workmen's time.



A CONVENIENT OIL TANK.



MECHANICALLY OPERATED SCREENING MACHINE.

A SCREENING MACHINE.

By A. G.

A HANDY little time saver is shown in the illustration. This is a mechanically-operated screen, used to sift shavings from the work when taken from small screw machines. The screen box may be lifted off and emptied at any time. With the screen in place, a boy dumps in a bucket of chips and screw machine products, and then goes for another lot. By the time he returns, the work has all been sifted and is ready for removal.

PUNCHING HOLES IN LOCOMOTIVE JACKETS.

By E. Avery.

THE machine shown is used for piercing holes in locomotive jackets. The punch-holder carries seventeen 3-16-in. punches for punching as many holes at once.

LOCOMOTIVE JACKET PUNCH.

From the method of attaching the punch-holder to the piston of the air cylinder, it will be seen that the two bell-cranks and toggles cause the holder to make an up and down stroke for each movement of the piston. Every time, therefore, that the piston goes up or down, the punches go down and up. This saves considerable time, and also utilizes the long stroke of the piston.

Notes and Observations on Modern Foundry Practice--II.*

By R. Onions

In the introduction to his paper, the author referred to the fact that the art of iron founding was in existence previous to the written records of history. He at the same time hazarded the suggestion that to the scientist and practical man of to-day it offered not only a wide field for research, but one also in which individuality had the widest possible scope.

IN our June 17 issue, the subject matter discussed consisted of core-making, green or dry sand castings, machine molding, plate molding, chills, cupola management, castings cost, management and organization.

Runner Basins and Gates.

Runner basins and gates are the channels found in the sand and provide the way by which the metal enters the mold from the ladle. They also serve to feed the mold after the pouring by means of a rod worked up and down by hand, giving a kind of impact to the metal itself, which fills up any thick portions that may have been drawn upon as the casting cools. The cavity where the metal is first received from the ladle is known as the runner-basin. All vertical passages are known as down gates, and the horizontal passages as in-gates or sprues.

As shall be seen directly, the disposition, shape and area of these gates and basins are important and interesting details. They bring into play principles, such as are met with in hydraulics, as vortices, centrifugal force, velocity and momentum, each of which property may be eliminated or taken advantage of as may be considered desirable for any particular case. On them depends the fate of the casting, and whilst in some cases a clean casting may be got at the expense of an enormous riser or header, it will be found, with a more suitable gate, that a much smaller header, or indeed no riser at all, will be required.

Molder's Experience a Factor.

The moulder has to rely entirely upon his experience as to what combination of the principles involved will form the best runner for any particular case. Generally, the metal must enter the mould quietly, and with as little velocity as possible. There are instances, however, where a fairly high velocity is a distinct advantage, as in the case of a ring or line, Fig. 1. Then, a small in-gate is made at a tangent to the mould, and a large down-gate. We as a result have a swirling motion which keeps the metal agitated, and so the dirt, being lighter and not allowed by the agitation to cling to the core or mould, is carried to the top. This swirl, under favorable conditions, will be maintained to a height of 18 in. or 20 in. in a liner with a 15-in. core and 1¼-in. metal. As this principle cannot be taken advantage of for liners which are over 20 in. long, other means have to be resorted to, and other difficulties creep in for which provision must be made.

Runner-Gate for Long Liners.

Fig. 2 shows an arrangement of runner-gate and sprues which have been found

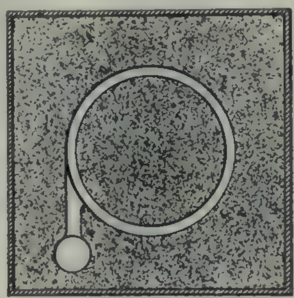


FIG. 1. GATING TO PRODUCE A SWIRLING MOTION.

to do well on long liners. In this case we have to keep the metal "alive" or agitated as well as possible all the way up, whilst we have also to counteract the cooling influence of the core and mould because of the relatively large surfaces exposed to the metal. It will be noticed that the metal falls direct from the runner-basin into a knob, with which the in-gate is connected, and this leads to an annulus formed around the core, from which lead several small

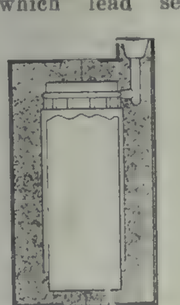


FIG. 2. GATING FOR LONG LINER.

sprues, equally spaced all around. It will be seen that with a large down-gate exceeding the combined area of the small channels, the metal will fill the knob, and also keep filled the annular space, and so make all the small sprues effective.

We then have a kind of shower bath, which is falling all the time on the surface of the metal, keeping it in agitation, breaking up the kish and oxide which forms into a mass as the metal is rising, this mass being easily caught by any depression or belt on the liner, and so carrying the dirt to the top. The in-gate in this case is made a little taper so as to increase the velocity of the metal and send it as quickly as possible around the core, and so, by coming in close contact with the core and mould, keeps the surfaces heated in front of the rising metal. Large liners may be cast in this way with a riser only a few inches long and no thicker than the casting itself.

Runner-Basin Features.

It may be well here to examine what features there are common to runner-basins and gates, which are found in practice to give good results, and the reason why. Fig. 3 illustrates an ideal form of runner-basin, and common to all conditions. In this a knob is provided, into which the metal from the ladle is poured. By this arrangement the metal is instantly quietened, and the velocity as it leaves the knob is so small that any dirt has time to float. It will also be noticed that the shape of the basin immediately over the down-gate is square, and it is most important that it should be so, because it goes to prevent a vortex, as it is well known that any swirl over the gate tends to bring down dirt which would otherwise remain in the head. With this form, no vortex can be noticed until the metal gets about half-way down the basin; this is a detail the importance of which moulders generally do not appreciate.

The flow of metal from the ladle to the runner-box is under observation, and the rate at which it is poured may be regulated so that the header is always about full, and by ordinary care a constant supply can be maintained, which goes towards a quiet entry, and minimizes splash. Whilst this form of basin may take a few more minutes to make than other forms, it will be found to pay well to adopt, and where specially clean work is required, a plug should be used over the gate, to allow of the basin being filled.

Simple But Unsatisfactory Runner-Basin.

In Fig. 4 is shown a form of runner-basin which is much more simple and quicker to make. It is, however, unfortunately an exception to the general rule in foundry work that the simplest and

*From a paper read recently before the Manchester Association of Engineers.

least-complicated is the best. This is a runner-basin of the worst kind, and, it will be seen, defeats all the points those shown in Fig. 3 are designed to achieve. We have here a basin situated directly over the down-gate, which has the objection that the the metal is most likely to splash in the mould, particularly on the commencement of pouring, where the man handling the ladle often gets in such a position that too much metal is leaving the spout, and this he suddenly checks to a too small amount, and so the pouring oscillates as it were for a second or two before settling down to a regular flow.

It may easily be seen that, as regards Fig. 3, any such irregularity does not tell directly on the down-gate. Metal if allowed to rush into a mould causes by its momentum undue pressure, strains the mould, tending to lift the top box, and is a common cause of run-outs. The funnel shape also encourages the formation of a vortex, and, if the pouring be observed, a swirl may be seen on the surface even when the basin is quite full. Whilst this form of runner-basin is freely used in some foundries, it has little recommendation beyond its cheapness, and on investigation it will be found responsible for a good many wasters. It may be good enough for some jobs but it would be difficult for the management to discriminate what head box to use.

Serviceable Form of Gating.

Fig. 5 shows the best form of gating for the great majority of castings. If we follow the course of the metal from the runner-head, the construction of the passages at each point is such as will give a quiet entry of the metal to the mould, and without much velocity, an entry at or near the bottom of the mould, and without splash. The in-gate should be placed at such a position that the metal will have a continuous and definite flow from the moment it enters the mould, entering at or near the thinnest portion, so as to have the hottest metal at the light section, and if a feeding-gate be considered necessary, this should be placed over the heavy section. In order to get these conditions, the down-gate from the basin is distinctly smaller than the down-gate in the drag or the in-gate to the mould. The down-gate from the cope discharges into a knob as also the down-gate in the drag.

These knobs serve much the same purpose as a dashpot to a governor; they control any sudden rush or irregularity, the object being to give a uniform and quiet flow. This saves many castings from scabs or pellets being shot all over the mould, chilling in their flight with a coating of oxide, from which state they do not usually melt again, but are found on the top of the casting. These pellets are generally considered to be due to phosphide eutectic.

Cylinder Head Experience.

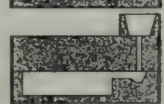
Here it may be well to relate an experience with several cylinder heads. These castings were so full of pellets they had to be scrapped, and on en-

FIG. 3. IDEAL RUNNER BASIN.

FIG. 4. BAD RUNNER BASIN.

quiry it was found that the gate had been put on the casting, the moulder's intention being to drop the metal between two cores; owing, however, to the gate not being straight, the metal had been playing against the corner of one of the cores, which shot the metal across the mould into pellets below a flange, most of them being trapped there. A great many of them came to the top of the casting, however, the iron used only showing on analysis 0.3 per cent. phosphorus, and the pellets gave just the same percentage.

Gates made in the way just described give good results in regular practice; but they are in direct opposition to the contentions of many authors on foundry



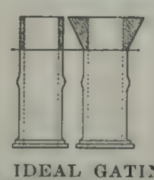


FIG. 5. IDEAL GATING.
FIG. 6. GENERAL FORM OF GATING.
FIG. 7. GATING HINDERING FREE ESCAPE OF GAS.
FIG. 8. HEADERS GIVING SAME METAL PRESSURE.

work, who, however, do not always state their reason.

Miscellaneous Service Gating.

Fig. 6 shows the class of gate as used for moulds generally, and, when choosing this type, consideration must be given to the depth of mould and bulk of metal. If danger be anticipated from high drop of metal into mould, Fig. 5, gate should be used. It is, however, desirable to retain the knob, and the down-gate should form the controlling area for the reasons already given.

In the case of a silencer for internal combustion engines we have a casting covering a considerable area and casting covering a considerable area and having an exceptionally large core compared with the bulk of metal. If the whole of the gas and air from the core has to escape through the branch at the end, the down-gate has to be comparatively small so as to fill the mould at such a rate as will allow the gas to escape. To counter-balance the cooling effect of the large exposed area, the metal has to be cast as hot as possible.

Again, we may have a mould with a thin section of metal and containing several small cores, each having points of connection through which the gas and air can escape. Here we have to provide for the large cooling influence of the cores, and so the casting has to be run sharply with hot metal. A quick cast in such cases is permissible because of the facilities for venting, which allow the air to escape as it is chased in front of the rising metal.

Balance-weights and hammer-blocks should be cast with a large gate. If this class of work is not cast smartly, the top of the mould runs the risk of being drawn down, due to long exposure of heat while the mould is filling.

Solid pieces are better cast with an in-gate three or four times the size necessary to fill the mould, and the rate of filling regulated by a plug in the runner-box. This will be found to feed most castings without the use of a rod through the riser.

No rule can, therefore, be laid down governing the area of gates; this is a matter which must be left to experience. Some moulders, after considering the design, weight, and area of a mould, will say that it should be cast in, say, 40 seconds or 1 minute, and on this basis the area of gate may be arrived at approximately.

Surface Blackening of Runner-Gates.

The whole surface of runner-gates and sprues should be carefully blackened. If in long down-gates the ordinary swab cannot be got to the bottom, it must be fastened to a rod. Should this precaution be not observed, the gates will be scabbed, indicating where patches of sand have been washed into the mould. The cause of many otherwise mysterious defects will be located by an examination of the gate before it is broken off the casting. It is remarkable the number of experienced moulders who will neglect this most important detail by blacking the mouth of the gate only.

As to risers and headers generally, it will be found that moulders incline to

the belief that a comparatively big quantity of metal at the top is an advantage. If, however, the runner-basin and gates are properly made, very little dirt will have to be accounted for. A few extra inches will be found as good as a foot, and so the only other advantage that may be expected is to so construct the head that this will be the last part of the metal to set, and thus the feeding-rod may be used to the best advantage. The pressure due to the extra depth of metal, whilst a distinct advantage, is no more than will be obtained by an ordinary feeding-plate of equal depth.

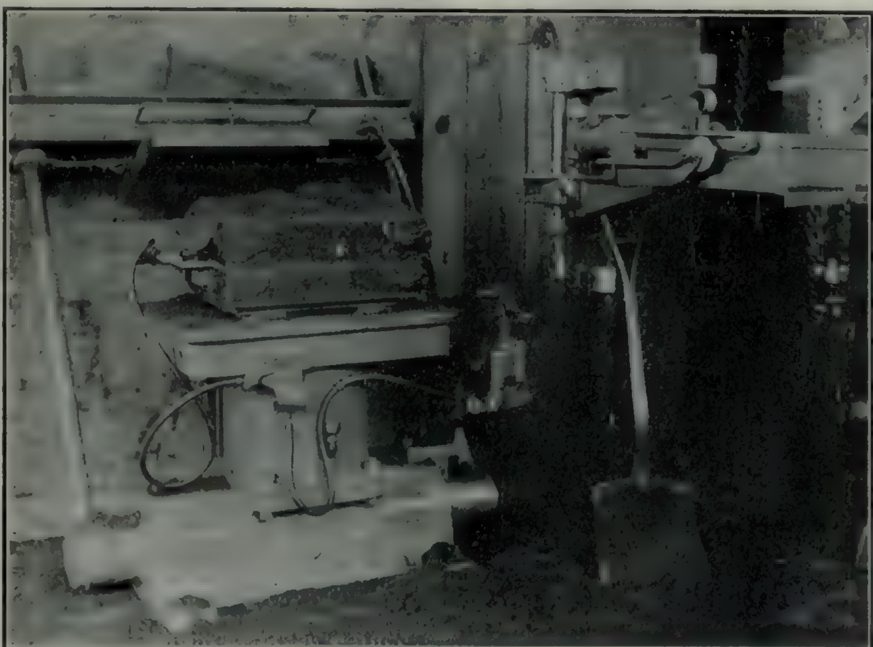
Some foundrymen do not appear to have sufficient confidence in their hydrostatic knowledge to say that the pressure due to the head is the same in both cases, Fig. 8. In the right hand sketch, however, there is a considerable amount of metal in bulk, often amounting to one-half the weight of casting required. This large bulk of metal will remain fluid long after the bottom portion has set, thus proving a real disadvantage, not only increasing the cost, but by the slow rate of cooling, allowing the carbon to separate out in large flakes, making the top of the casting more open.

PNEUMATIC SIFTER FOR MOLDING MACHINES.

MOLDING machine users will doubtless be interested in this latest type of pneumatic sifter. It swings on a vertical shaft, which is held in brackets fastened to a wall or post, and is furnished with an automatic valve which admits air to the cylinder for starting the machine as it swings into place over the flask, and cuts off the air when swung back out of the way, this operation being almost involuntary on the part of the molder.

The screen box is rectangular in shape and arranged so that screens of different meshes can be used. The wire cloth is slipped into a space between two angles and securely held in place by a cap screw and washer in front of the screen box, thus providing an easy means for changing the screen. It can be dumped and cleared of the coarse material by lifting one end off the frame, while the other end swings on two bolts. When in operation, the loose end of the box is held in place by a spring catch.

This shaker will be found convenient for applying facing sand, the screen box containing enough sand for several molds, thereby avoiding the fatigue incident to lifting the full riddle above the flask for each mold when riddling by hand. The machine is furnished with screen box, either 9 in. wide by 12 in. long, 12 in. wide by 14 in. long, or with screen holder to accommodate an 18-in. riddle. The Hanna Engineering Works, Chicago, Illinois, are the manufacturers.



PNEUMATIC SIFTER SHOWN DRAWN BACK, READY TO SQUEEZE MOLD.

SELECTION OF EMPLOYEES.

IN a talk on "First Aid" before the Newark, N.J., Foundrymen's Association recently, Dr. Henry Satchwell, of that city, emphasized the need on the part of employers to give more and stricter attention to selection of their employees, as nearly all accidents give opportunity of liability claim being made against them. He said:

"All workmen should be subjected to medical examination, in order that all hidden defects, either physical or mental, shall be known in advance. Injury by accident to the normal workman is a small factor; by far the greatest loss is from accident to the diseased man. If a sick man is well enough to get work, but is afterward injured, the employer is totally liable; therefore, the great importance of selecting labor. It will save more money than all subsequent economies. In foundries, where a great part of the work is heavy, ruptures are the bugbear. Heart disease, weak arterial walls and similar deficiencies incapacitate a man for such labor.

"The proper reporting of accidents is a duty that all manufacturers should require. It serves more than one purpose. It gives the employer a chance to check up false claims and to apply the right treatment at the earliest possible moment. Regulations for reporting accidents are almost worthless unless a penalty is attached to the failure to report.

"It has been found that factories that pay well both in wages and in medical treatment have the least trouble. It has been suggested that if the careful inspection of employees should be carried out, a large class of workmen would be unable to find employment. This would call for a legislative remedy, one that would enable a company to hire a man without being liable for disability caused or contributed to by some existing disease of the man."

SUBSTITUTE FOR WOOD IN PATTERN-MAKING.

A COMPOSITION that has many advantages over wood for small patterns can be made as follows With hot water mix into a thick paste three parts by volume of starch, one part ground glue, two parts fine resinous sawdust. The sawdust should not be added until the starch and glue have been dissolved by the water. After the ingredients are thoroughly mixed, heat the whole to 190 degs. Fahr., and continue the heating until the whole become a hard mass, then allow to cool and remove from the receptacle. The resulting composition is a strong, hard, horn-like substance that can be machined, sand-papered, and varnished the same as wood.

The principal advantage of this composition over wood lies in the fact that it has no grain, and, therefore, turned and complicated patterns made from it do not have to be built up or glued together. For the same reason it is easier to turn and machine, and offers a smoother surface when finished. It is also more fireproof than wood and not so readily affected by atmospheric changes.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

HEAVY SPIRAL MILLING ATTACHMENT

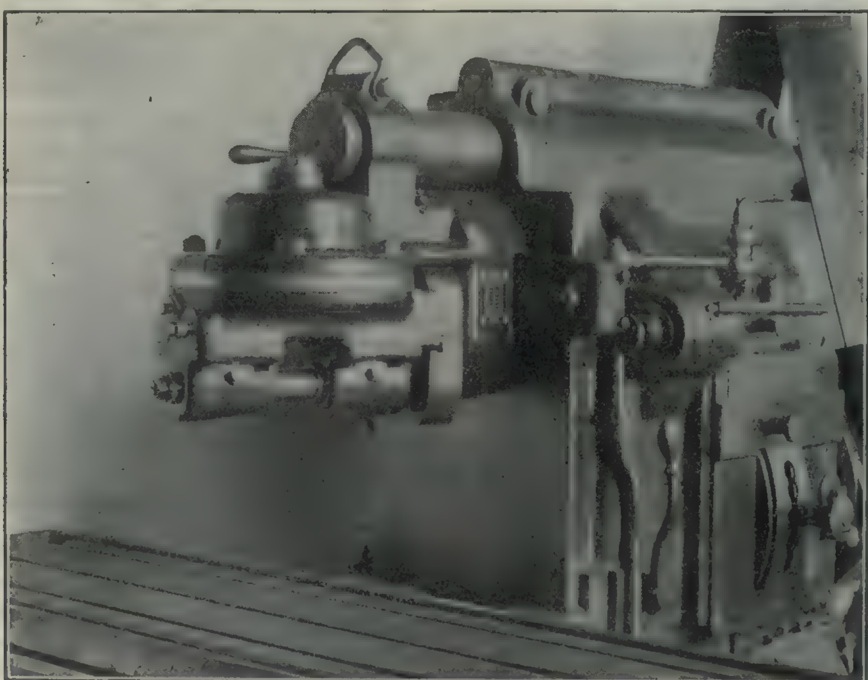
A RECENT addition to the extensive line of milling attachments manufactured by the Brown & Sharp Mfg. Co. of Providence, R. I. is a spiral milling attachment designed for the heavy class of spiral cutting. This attachment which is used in combination with a spiral head, is made in four sizes, making it adaptable to practically the entire line of plain and universal milling machines manufactured by the Company.

The illustration shows the attachment in place on the machine, from which it will be noted that the method of clamping to the overhanging arm as well as to the face of the column insures rigidity, and makes the attachment practically a part of the machine. To facilitate handling, provision is made for fixing a hook at the top of the attachment.

The spindle is hardened, ground, and runs in phosphor bronze boxes having means of compensation for wear. It is driven from the machine spindle by hardened steel spur and bevel gears, and can be set at any angle in a horizontal place, the position being indicated by graduations reading to half degrees. To insure rigidity and enable heavy cuts to be taken, the cutter spindle is provided with an outer bearing which can be easily removed when placing a cutter in position.

The inner spindle bearing is adjustable, the adjustment being made by a screw having a graduated dial on the front end of the attachment which reads to thousandths of an inch. This adjustment is valuable when setting the cutter central with the swiveling point, or when off-setting the cutter any definite amount. A suitable gauge is provided to enable the cutter to be set central with the swiveling point. This gauge slides in V ways on the attachment, a thumb screw clamping the gauge at any desired distance from the cutter spindle. The regular machine spindle speed change mechanism is used to obtain the different cutter speeds.

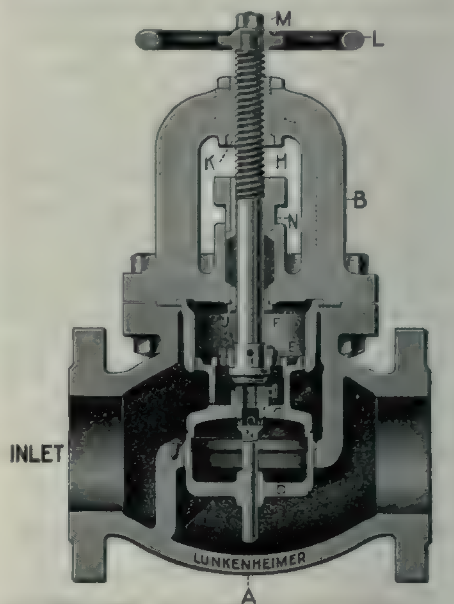
All gears and wearing surfaces are enclosed, preventing injury from dirt and dust as well as giving a neat and compact appearance.



SPECIAL MILLING ATTACHMENT FOR HEAVY SPIRAL CUTTING.

IMPROVED BALANCED THROTTLE VALVE.

A VALVE of exceptionally free and easy operation combined with efficiency is, of necessity, required for engine throttle purposes, and that here described and illustrated was designed with this object in view. There are practically but three moving parts—the main disc, the by-pass disc, and stem—and these, being of large proportion, are likely to withstand the hardest service to which valves of this type are subjected. The operation of the valve is as follows:



IMPROVED BALANCED THROTTLE VALVE.

Assume that the valve is closed and under pressure. As pressure will enter the balancing cylinder, by passing the piston ring and through the small hole in the bottom of the disc cylinder, its amount above the disc is equal to that in the inlet of the valve. This pressure aids materially in holding the disc C tightly to its seat, but unless some provision was made to relieve it, the valve would be extremely difficult to open.

The method of relief lies in the by-pass I, the opening through which is covered by the bottom of the stem H when the valve is closed. A slight turn of the handwheel, however, uncovers this opening and the steam above the piston will then pass through the holes in the retaining ring E, thence through the hole in the by-pass disc I and holes in the main disc guide stem N, immediately relieving the pressure above the piston. Any pressure that may escape past the piston ring or through the small hole in the bottom of the disc cylinder is also quickly relieved while the valve is being opened. The main object of the small hole in the bottom of the disc cylinder, is to drain the water of condensation that may accumulate when the valve is connected in a vertical position, with the handwheel up. When in a horizontal position, any water in the disc and

balancing cylinders will drain past the piston ring.

Both the main and by-pass discs are operated simultaneously by one movement of a single handwheel, which not only facilitates the quick operation of the valve, but insures the opening of the by-pass valve at the proper time. Provision is made for regrinding both the main and by-pass disc seating surfaces, should they become worn, and as all parts are renewable, the durability of the valve is increased. Annual extensions on both the seat and disc provide spring seating surfaces.

The body may be tapped anywhere above the seat or inlet end for drain connection, so that any water from condensation can be removed before the valve is opened. For the lubrication of the engine cylinder, the body can also be tapped on the inlet or outlet end, to which lubricator connection may be made.

This valve is made by the Lunkenheimer Co., Cincinnati, Ohio, in sizes ranging from 4 to 10 inches inclusive. To suit various conditions of superheat and pressure and to meet the specifications of engineers who differ as to the materials used for the different parts, they are made in six combinations.

MOTOR DRIVEN SPEED LATHE.

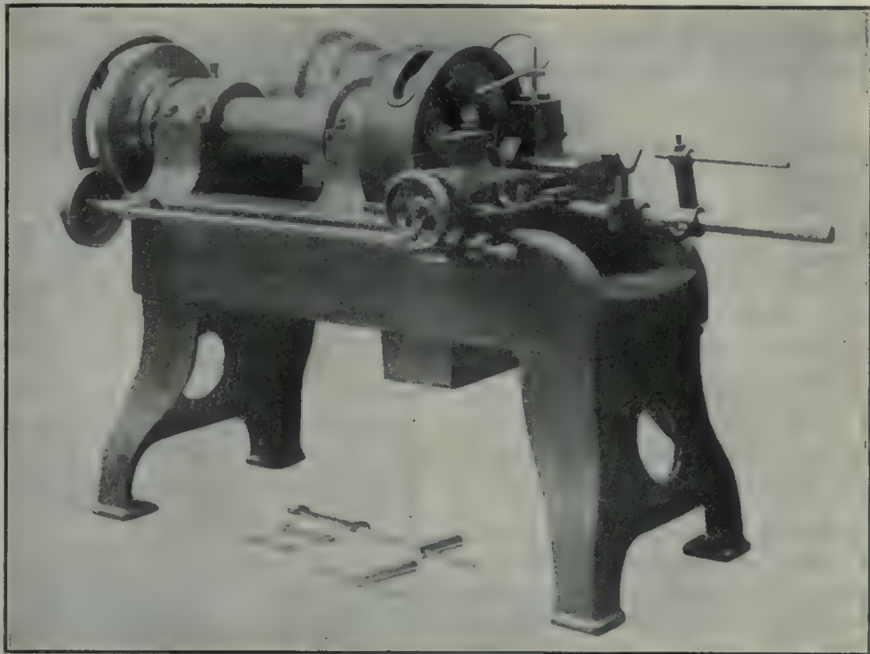
THE illustration and description refer to a motor driven speed lathe recently put on the market by the J. G. Blount Co., Everett, Mass. The style of motor drive with which the machine is equipped, employs a constant-speed motor mounted on a plate having an extension arm to support a bearing for the outer end of the motor shaft. The motor-plate is fitted to slide on a shelf securely fastened to the back of the lathe bed. This plate is operated by a screw which tightens and loosens the belt.

A four-step cone pulley is mounted on the motor shaft and belted to a four-step cone on the lathe spindle, which gives the same speed variation as a countershaft. By using various sizes of cones on the motor, wide ranges of speed may be obtained. The lathe spindle, which is made from high-carbon steel, ground to size, is hollow and bored for Morse taper. It runs in self-oiling bronze bearings. The tailstock has screw and lever feed; the bed is cross-braced, and the lever for operating the rest and tailstock is above the ways.

MOTOR-DRIVEN SPEED LATHE.

CUTTING-OFF MACHINE FOR SHELL BILLETS AND FORGINGS.

THE W. P. Davis Machine Co., Rochester, N.Y., has re-designed its line of cutting-off machines, and brought out new models of the $4\frac{1}{2}$-in. and 6-in. sizes. These machines are adapted to and are being employed in the cutting-off of billets and trimming the ends of shrapnel and lyddite shell cuppings when they come rough from the forges.



CUTTING-OFF MACHINE DESIGNED FOR TRIMMING THE ROUGH ENDS OF SHRAPNEL SHELL FORGINGS.

The $4\frac{1}{2}$-in. machine has undergone some radical changes in design, while many improvements have been added to the 6-in. machine. The bed of the former is cast in one piece, thus insuring rigidity. The spindle is of hard, clean cast iron, and rests in anti-friction metal-lined bearings that are part of the main casting. The supports for the cutting-off slide consist of large pads which are cast on the frame, providing ample support for the slide and eliminating as far as possible all chatter. The end of the bed is open to facilitate the removal of chips, and the bottom is inclined to drain off the cutting compound.

On the spindle just behind the front bearing is a collar, through which project four round nose bolts, intended to support the work when the piece is too short to be gripped in the rear chuck. At the front of the spindle is a heavy pattern three-jaw chuck, and, at the rear, a quick-acting scroll chuck, operated by hand wheel. The cut-off slide is provided with two tools. It has power feed and automatic trip, which acts when the tools reach the centre of the work. A stock limit gauge is mounted on this slide, and two V-shaped sup-

ports are placed to catch the stock when it has been cut off.

Neither the $4\frac{1}{2}$-in. nor 6-in. machines are provided with accelerating speed devices, as the four-step cone and double friction countershaft provide sufficient additional speed as the cutters approach the centre of the stock.

PNEUMATIC BANDING PRESS.

THE pneumatic banding press shown in the accompanying illustration is intended for compressing the copper band on 18-pdr shrapnel and high-explosive shells. The action is such that the dies strike a sharp blow and then exert a heavy pressure sufficient to firmly force the copper into the dovetail groove.

The production obtainable is only limited by the ability of the operator to handle the work, the actual time required for the press to set the band on each 18-pdr. (3.3 inch) shrapnel shell being from 7 to 8 seconds. The production with one operator is easily one shell per minute, and with two operators it will run as high as 3 to 4 shells per minute. The machine is self contained, and, in setting up, it is only necessary to connect the shop air line to the control valve furnished with the machine. The air pressure required is 100 pounds per sq. inch; the floor space occupied is 30 in. by 30 in., and the weight 1750 pounds.

This press was designed by the engineer of the Chicago Pneumatic Tool Co., of Cleveland, Ohio, and is being marketed by the Motch & Merryweather Machinery Co. of that city. We understand an attachment for nosing 18-pdr. shrapnel shells and smaller has recently been designed which will make the press a double purpose unit.

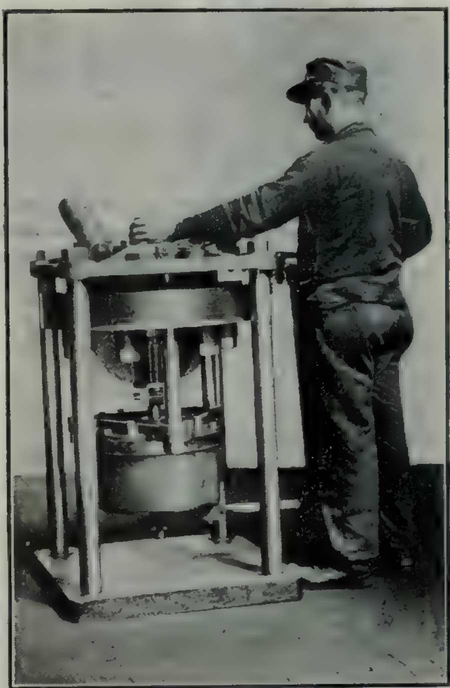
ELIMINATION OF WASTE.

THERE is no doubt that in the vast majority of factories much time and labor is spent on work that is non-essential. Much of this non-essential work is unheeded because the relation between it and its place in the final product is not considered. For instance, the relation between the production of any detail part of a machine and the use to which the machine will eventually be put is just this—the finished detail is only important in so far as it assists in giving the machine those productive qualities desired by the user.

The Drawing Office.

Consider the production of a complete machine from its inception to its installation in the user's shop. First of all there are the drawings to make. These drawings are not the final result desired; they are merely a means to an end and are essential only as indicators of the detail work required. Why, then, waste time in making a fancy border or beautiful copperplate lettering? If the drawing is correct, complete in its information and readable without straining the workman's eyes, it fulfils its purpose and any other work put into it is waste.

Much expensive pattern-making could often be saved if full consideration were given by the draughtsman to the making of the castings he designs. His usual practice is, however, to draw in a casting that will carry the shafts and other mechanism necessary, due regard being paid to its appearance but none to its production in the foundry. The result is often an expensive pattern with a multitude of loose pieces and the display of much annoyance, if nothing worse, by the moulder. A little knowledge and a little thought would have eliminated a great deal of such unnecessary work, which again can only be designated waste.


PNEUMATIC BANDING PRESS.

Lathe Work.

When the raw materials arrive in the machine shop, this waste of non-essential machining assumes very large proportions even in so-called well-regulated shops. Each individual workman has eyes only for his immediate job and does not comprehend it in relation to its ultimate function in the finished machine.

Take, as an example, a fast-running shaft with two bearings and a drive fit to carry a gear. Such a shaft is to be ground for accuracy after turning. All that the turner usually considers is the production of what he calls a "nice lathe job." This is all very well, but it necessitates an extra finishing cut, when one roughing cut would leave the shaft in a much better condition for the grinder to handle. Then why waste time over the finishing cut? It is not essential, it is waste.

Grinding.

Again, considering the same shaft, the bearing portions must of necessity be smaller than the bushes in which they run. It has been found after much painful experience that the limits for such bearings can be much wider than was previously considered permissible with beneficial results to the running of the shaft; no less beneficial is the shortening of the grinding time by imposing those wider limits. It may sound well to be able to say that shafts are ground to limits of half or quarter thousandths, but such boasters are often condemning themselves as waste producers.

The closer the limits, the longer the time required to grind. A bearing can be ground to limits of .001 inches in far less time than would be required for limits of .00025 inches. Extreme accuracy and close limits are often insisted upon where they are non-essential; the extra time spent in working to such a standard is therefore waste. The toolmaker is one of the worst offenders in this respect. He takes an inordinate pride in producing a nicely finished tool or jig, carrying his pride so far as to file and polish parts that do not require it, or working to extreme accuracy on dimensions that are unimportant.

A good casting needs very little or no filling before painting, and the excellence of its surface indicates that the metal is sound. Beware of superfluous or artificial finish; it is non-essential and therefore waste; it may indicate that there is bad workmanship to hide.

Shop System.

Another aspect of this question, where waste often runs riot, is shop system. The great danger with many systems is that they tend to become more essential in the minds of those responsible for them, than the end to which they are, after all, only the means. In many factories to-day, there is too much signing of tickets and cards. Records must be kept, but they should also be kept in subordination. The works do not exist to carry out the system, the system exists to guide and record production.

Do not pin all your faith on the economies to be obtained by installing new methods: consider first of all where waste can be eliminated in the old methods.—Herbert's Monthly.

Armour Piercing Shells.—Shells for armour piercing are now fitted with a soft steel cap which, when the shell hits the armour, is forced back and at the same time stretched until it forms a ring through which the shell passes into the armour.

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PRINCIPAL CONTENTS.

"SHELLS, AND SHELLS, THEN MORE SHELLS."

THE announcement that all contracts in the hands of the Dominion Shell Committee on behalf of the British War Office have been placed has come upon our engineering and metal working plants administrations as somewhat of a surprise. Most of us during recent months had become disabused of the idea that the war was entering on its closing stages, and had unhesitatingly expressed the opinion that the combatants had not more than developed elementary, although essential campaign preliminaries. We were of course supported in our diagnosis of the situation by the wide publicity given to the matter of shrapnel and high explosive shell shortage, and by the incessant and wholesale blackguarding of the British operative because of his apparent lack of appreciation of the necessities of the situation.

Making all due allowance for the large-in-quantity and widespread-in-distribution contracts placed in Canada, many of which have not yet reached the production stage, at least so far as the high explosive shell is concerned, there is not a little concern being evinced—it may perhaps only be curiosity, as to further orders when those on hand are filled, and the war still raging. We have on previous occasions hinted at our shell-making industry as being a stop-gap proposition—until the British plants had established, extended and equipped themselves on a war-time basis, and color has been lent in recent days to such a possibility by the ease and facility with which our mechanics are being drawn away from our shores. The situation is indeed an interesting one, and may become intensely so very quickly.

Since the outbreak of this devastating European war, all sorts of interesting situations have arisen and the most unlooked for developments have taken place. Not the least of these latter was the decision to manufacture shrapnel shells in Canada. Experiment proved that we could, and the experience of the past few months has established the fact that our engineering and metal working plants can produce shells on a scale commensurate with manufacturers elsewhere on an equivalent opportunity basis. We are still of opinion that the war will be a long one—just how long, however, it were idle even to hazard a guess. That many more, and larger than ever, shell contracts will be placed with our machine shops, admits, we believe of no contrariwise opinion, and practical exemplification of this view is to be had in the almost mushroom growth of new factories and of extensions to those already existing; the avowed purpose being the production of "shells, and shells, then more shells."

A hitherto unrealized appreciation of the requirements of our Empire and her Allies in the matter of shells has now been grasped, and the timidity previously in evidence relative to investment of capital in plant additions and equipment has disappeared. What seemed a month or two ago as "long odds" in breaking even on capital outlay has developed into a "sure winner," and the only uncertainty, if such now exists, is the amount of the "purse" to be obtained. Intuitively, big things are not only expected, but are believed to be in process of development as regards shell manufacture in Canada.

The work of our Shell Committee has been no sinecure and of course in no such circumstances could it or will it be. Their experience is now of inestimable value, both to our own and the Imperial Government. A real measure of our shell production capacity has been secured and our aptitude to quickly develop and increase it has been specially noted. War-time expenditures of money always relate to millions, likewise the expenditure of ammunition. Viewed in the light of our Empire requirements, present and prospective, and having regard even to the fact that shell orders placed by our Shell Committee have already gone into three figures of millions, it may, when peace again reigns among the nations, be found that the orders for British shrapnel and high explosive shells, and for which all contracts on hand are presently let to our manufacturers, constituted but a forerunner of many similar orders.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	.....	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.10
Steel bars, f.o.b., Toronto	2.10
Common bar iron, f.o.b., Montreal	2.15
Steel bars, f.o.b., Montreal	2.15
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.25
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled	14 00	14 00
No. 1 machine, compos'n	12 50	12 50
No. 1 compos'n turnings	9 25	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	5 00	5 00
Tea lead	$3 75	$3 75
Scrap zinc	14 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 3, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	39	....	....
½ in.	68	48	....	....
¾ to 1½ in.	73	53	....	....
2 in.	73	53	69	49
2½ to 4 in.	73	53	72	52
4½, 5, 6 in.	....	....	70	51
7, 8, 10 in.	....	....	67	48
X Strong P. E.				
¼, ⅜ in.	56	39	....	....
½ in.	63	46	....	....
¾ to 1½ in.	67	50	....	....
2, 2½, 3 in.	68	50	....	....
2 in.	....	....	63	47
2½ to 4 in.	....	....	63	50
4½, 5, 6 in.	....	....	66	50
7, 8 in.	....	....	59	42
XX Strong P. E.				
½ to 2 in.	44	29	....	....
2½ to 4 in.	....	....	44	29
Genuine Wrot Iron.				
⅜ in.	57	33	....	....
½ in.	62	42	....	....
¾ to 1½ in.	67	47	....	....
2 in.	67	47	63	43
2½, 3 in.	67	47	66	46
3½, 4 in.	....	....	66	46
4½, 5, 6 in.	....	....	63	44
7, 8 in.	....	....	60	41

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$21 00	$21 50
Electrolytic copper	20 75	21 25
Castings, copper	20 50	21 00
Tin	45 00	45 00
Spelter	26 00	26 00
Lead	7 50	7 50
Antimony	40 00	40 00
Aluminum	32 00	30 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.65
Linseed oil, boiled, single bbls.	0.80
Linseed oil, boiled, single bbls.	0.83
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40 to 45%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 50
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	6 40	6 40
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	6 30	6 30
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	6 30	6 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07½
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., June 24,1915.—The general situation is much the same as last week, the manufacture of shells being the most interesting feature in industrial circles. The expenditure on shells represents more money distributed than for any other single product, and indications point to an increase in the appropriations for this purpose. The importance of the shell industry is being more fully realized and orders for shells from the French and Russian Governments will probably be placed direct with Canadian manufacturers. This business in addition to the Shell Committee contracts will be a source of additional interest to the firms engaged upon this work. Foreign business is developing in other lines also. The Russian and French Governments have placed large orders for cars with the Eastern Car Co., and further interesting business is in sight. The Canadian Locomotive Co., have received an order for locomotives from the Russian Government which will keep the plant busy for some months. The British Government has appointed a representative to supervise contracts placed in Canada and the States, the result will probably be that more contracts for war material and supplies will be placed in Canada than heretofore.

The Steel Market.

The most interesting feature in the steel market continues to be the shell business for which the tonnage is steadily increasing. Orders for 4.5 high explosive shells are being distributed in greater numbers and the making of 60 pounder shells is under consideration. A large order for high explosive shells for the French Government is ready for distribution and further Russian contracts will no doubt be placed with Canadian plants. As regards domestic requirements, the steel trade is certainly dull but the prospects for business resulting from the war are much brighter and may develop substantially; in some lines an improvement is already noticeable. A little heavier tonnage in reinforcing bars is reported and there is a better enquiry for bridge sections. The building trade continues dull, generally speaking, and there is a corresponding light demand for structural shapes. Prices on bars are firm but unchanged.

Another advance in galvanized plates has been made due to conditions in the spelter market. Although spelter has fallen, there has been little improvement in the situation. The price is still far too high to suit the galvanizing trade, and galvanizers are staying out of the market. The present abnormally high prices are expected to prevail until the demand declines considerably. Galvanized sheets have advanced $1 per cwt; prices are given in the selected market quotations.

The steel market in the States continues to improve both in tone and in tonnage. War orders are on the increase and domestic business is improving. Large orders for rails and cars from the Russian and French Governments have been placed with American plants, while Russia has also ordered a large number of locomotives. Prices of steel products are very firm and billets have made a slight advance.

Pig Iron

There is no change in the pig iron situation. Business continues quiet and prices unchanged.

Scrap Metal

Prices of copper and brass scrap are very firm at the advance announced last week. Lead and zinc on the other hand are weaker and declining. The active demand for copper and brass scrap continues but other metals are quiet. Heavy lead is now quoted at 5c, tea lead at 3¾ and zinc at 14c per pound. The iron and steel scrap market is quiet and unchanged.

Machine Tools

Machinery dealers report very brisk business, the only trouble being difficulty of obtaining anything like satisfactory deliveries. The situation in this respect is getting worse rather than better, and orders are being held up on this account. With more firms continually going into the shell business and makers of tools working night and day, this will give an idea as to difficulties that have to be faced. Second hand tools are in great demand and also tooling fixtures for making shells. Prices of certain machine tools have advanced as much as 20 per cent since the beginning of the year due to increase in wages and manufacturing costs. The labour situation is causing some uneasiness, for, in the addition to a shortage of tool makers, a considerable number of men have left or are leaving for the Old Country to work in shell plants there.

Supplies

The supply business is brisk on account of the shell business. There is a good demand for tool steel, belting, cutting compounds and waste. Solders have all advanced in sympathy with the tin market, and Manila rope is higher being now quoted at 16c per pound base. Red lead is unchanged but may advance again if the market for pig lead holds at the present level. Prices of brass goods are very firm but unchanged; makers are waiting developments in the metal markets.

COMING CONVENTIONS.

Associated Advertising Clubs of the World, Chicago.—June 20 to 24.

American Society of Mechanical Engineers, Buffalo, N.Y. (Spring Meeting.)—June 22-26.

American Society for Testing Materials, Hotel Traymore, Atlantic City, N.J.—June 22-26.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

ALLIES PURCHASING AGENTS.

The Trade and Commerce Department, Ottawa, has published the following list of purchasing agents for military purposes for the allied Governments:—

International Purchasing Commission, India House, Kingsway, London, Eng.

British.—Col. A. G. Barton and F. W. Stobart, Ritz Carlton Hotel, Montreal.

French.—Hudson Bay Co., 56 McGill Street, Montreal; Captain Lafoulloux, Hotel Brevort, New York; Direction de l'Intendance Ministere de la Guerre, Bordeaux, France; M. De la Chaume, 28 Broadway, Westminister, London.

Russian.—Messrs. S. Ruperti and Aieksieff, care Military Attache, Russian Embassy, Washington, D.C.

Metals

Spelter and lead are the only markets which have declined although copper has a weak tendency. The tin market is firm but quiet and antimony is dull but showing no signs of weakness. Business in metals for munitions is very active but ordinary business is quiet although there are indications of some improvements.

Tin.—The market is steady at the advance reported last week. Since the good buying movement of two weeks ago, the large consumers have shown little interest. Local quotations are unchanged at 45c per pound.

Copper.—The copper market is dull with a weak tendency. The consumption of copper continues heavy and the position is a strong one. Quotations are unchanged at 21c per pound.

Spelter.—The reaction in the spelter market continues and lower prices have been reached. The market is dull and unsettled and the situation cannot be said to have improved. Consumers are staying out of the market and are showing no interest in any position. It is suggested in some quarters that the market has been manipulated but the falling off in demand may be the reason for the decline. Spelter has declined 2c and quotations are nominal at 26c per pound.

Lead.—The market has reacted, the Trust having reduced their price to the basis of 6c at New York. The advance last week was apparently not justified, and it is suggested that the Trust reduced their prices to discourage speculation. The market is unsettled and has a weak tendency. Lead has declined ½c and is quoted locally at 7½c per pound.

Antimony.—The market is dull but there are no signs of weakening. The antimony position is serious as there is a prospect of increased demand with difficulty in obtaining supplies. Quotations are nominal at 40c per pound.

Aluminum.—The market is strong and advancing. Local quotations have advanced 6c and are entirely nominal at 30c per pound.

St. John, N.B., June 19, 1915.—The war has proven a benefit to those interested in the development of antimony mines, and there has been renewed activity by the Canadian Antimony Co., at Lake George, Prince William, York,

THE A. R. WILLIAMS MACHINERY CO., LTD.

ST. JOHN, N.B. TORONTO WINNIPEG VANCOUVER

Canada's Leading Machinery House

FULLY EQUIPPED IN 30 DAYS

You can be turning out High Explosive or 4.5 Lyddite Shells in 30 days from date of signing your contract if you will take advantage of our

SPECIALLY ORGANIZED BUYING SERVICE

We have obtained the services of experts in the principal manufacturing centres of the United States and are anticipating the needs of manufacturers who contemplate equipping *by purchasing ahead of actual orders.* With this feature linked up to our

FREE GENERAL INFORMATION AND SERVICE DEPARTMENT

We are the best organized concern in the country for taking care of your requirements. Let us show you

"DELIVERY'S THE THING!" *"IF IT'S EQUIPMENT—WRITE "WILLIAMS."*

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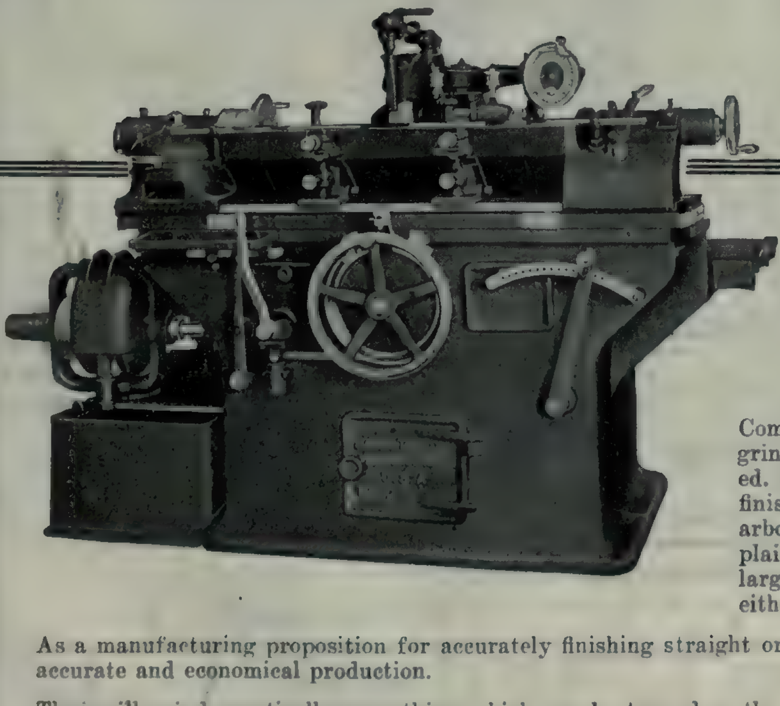


Combined Manufacturing and Tool Room Grinding Machine

Combining as it does both an **external** and **internal** grinder, its field of usefulness is practically unlimited. It is especially adapted to tool room service, for finishing such work as **straight** and **taper** spindles, arbors, rolls, male and female gauges, dies, reamers, plain angular and forming milling cutters and a large variety of other work which can be held by either a face plate or chuck.

As a manufacturing proposition for accurately finishing straight or taper parts—external or internal—they assure accurate and economical production.

They will grind practically everything which can be turned on the lathe.

LANDIS TOOL COMPANY

Main Office and Works:
WAYNESBORO, PA., U. S. A.

Manufacturers of Grinding Machines for Cylindrical and Conical Surfaces

Universal Grinding Machines
Plain Grinding Machines
Roll Grinding Machines
Crank Grinding Machines
Internal Grinding Machines
Cam Grinding Machines

Canadian Agents—A. R. Williams Machinery Co., Toronto ; Williams & Wilson, Montreal

N.B. The directors of the company met in St. John this week in annual session. A proposal to lease the mine to a syndicate for a period of four years was received, while there was said to be also a possibility that a sale of the mine would be made to a company desirous of carrying on operations. Prospects are particularly encouraging for the establishment of the industry which affords employment to about seventy-five men.

Officers were elected at the meeting, as follows:—A. R. Slipp, M.P.P., K.C., of Fredericton, N.B., president; W. J. Francis, Montreal, vice-president; H. A. Porter, St. John, secretary; C. N. Crowe, Bridgewater, N.S.; F. W. Fairman, Montreal; H. Lindsay, Halifax; and Dr. W. J. Irvine, Fredericton, additional directors. Reports presented showed that when the company closed the mine in 1909 the price of antimony was only 6 cents a pound, while to-day it brings from 36 to 40 cents a pound. Managing Director Crowe was authorized to continue the negotiations for the sale of the mine, while the proposal to lease it for a four-year term was also considered at some length. Action will be taken at a meeting to be held soon.

At a meeting of the Stove and Sheet Metal Dealers' Association this week in the Board of Trade rooms, recognition was made of the gallantry of Lieut.-Col. J. L. McAvity and Major Sturdee in going on overseas service from Canada. The former had occupied the position of president of the Association, and Major Sturdee had been secretary. Because of their service to their country, it was unanimously decided to have them still nominally hold their respective offices during their period of service, though the duties would be attended by others. Harold Wilson, vice-president, occupied chair in the absence of Col. McAvity, and D. J. Barrett acted as secretary pro tem.

From the factories, offices and stores of the firm of T. McAvity & Sons, Ltd., St. John, thirty-nine men have given up their positions for the time being to serve King and country, some now overseas, in France or England, some others getting ready to go. An honor roll has been prepared, showing the names of the volunteers in alphabetical order as follows:—W. R. Allan, Lloyd Bradshaw, Edgar Brown, Wm. Burton, Fred. B. Campbell, B. H. Colpitts, Allen C. Coster, Arthur Crayton, J. T. Davidson, Chas. I. Dunfield, Harold Duplissea, Louis Gallagher, Harry Gibson, Anthony Howe, Ernest Jenkins, George Kelley, Fred. Marshall, Frank J. Murphy, Jas. L. McAvity, P. D. McAvity, Ronald A. McAvity, T. Malcolm McAvity, Chester B. McBay, George McNutt, Alex. Nesbitt, Chas. Noddin, Geo. North, Daniel Oram, Gus. Salamson, Wm. Scribner, L. G. Seeley, Wm. Smith, Albert V. Sowery, Geo. Spinney, Fenwick Tait, James Telfer, John K. Trifts, John Varnor, Lee Vincent. Included in this showing of volunteers are members of all ranks from private to lieutenant-colonel.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Pembroke, Ont.—The T. Pink Mfg. Co. are making shrapnel shells.

Sidney, N.S.—The town is in the market for 23,000 pounds of lead.

Halifax, N.S.—The machine shop of T. Hogan & Co. has been destroyed by fire.

Medicine Hat, Alta.—The Dominion Harvester Co. are equipping their plant for making shells.

Barrie, Ont.—The Canada Producer & Gas Engine Co. are negotiating a contract for shells.

Windsor, Ont.—The city council propose purchasing a boiler and equipment for the pumping station.

Renfrew, Ont.—The Renfrew Machine Co. plant was damaged by fire recently to the extent of $3,000.

Hamilton, Ont.—The Canadian Hart Wheel Co. contemplate the erection of an addition to their factory, estimated to cost $3,000.

Bridgewater, N.S.—The Acadia Gas Engine Co. are making considerable extensions to their plant and will install new machinery.

Bridgeburg, Ont.—The Tuttle-Bailey Co. and the Flanders Mfg. Co. have been awarded contracts for making shells for the French Government.

Kelowna, B.C.—The installation of a hydro-electric plant is being considered by the council. DuCane, Dutcher & Co. of Vancouver, are the engineers.

Kincardine, Ont.—The Hunter Bridge and Boiler Co. is fitting up the old Fisher foundry and will install the new machinery necessary for the manufacture of shells.

Sherbrooke, Que.—The city council are considering installing a gas plant at an estimated cost of $70,000. Ald. Brault is chairman of the Gas and Electric Light Committee.

New Toronto, Ont.—The New Toronto Cider Mill which has been vacant for over two years, has been purchased by an American firm and will be used for the manufacture of munitions of war, principally shells. Extensive alterations are being made and a quantity of special machinery will be installed.

Chatham, Ont.—The plan to have shells made in the Defiance Plant has been endorsed by the Board of Trade and the city council was asked to give special consideration to any firm or persons who would use the plant for such purpose.

Cobourg, Ont.—Work has started on a building for George Thompson for making shells. The machinery is being purchased and the plant will be ready shortly. J. E. Chambers is the superintendent. Maclean, Stone, Robson & McCurdy of Toronto are interested.

General Industrial

Winnipeg, Man.—A. E. Hilder proposes to establish a vitrified brick and tile plant here.

London, Ont.—A fire destroyed the factory of the Thompson Knitting mills. The loss is estimated at $20,000.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

Walkerville, Ont.—The Peabody Mfg. Co. factory was damaged by an explosion of dynamite on June 21. The damage is estimated at $10,000.

Stanstead, Que.—Loomis, Dakin & Co. have commenced work on the new Butterfield factory. The contract calls for one building 60 x 160 feet, three stories and basement, another 60 x 145 feet, one storey and basement. The walls will be of solid brick and steel, the foundations and floors of concrete.

Edmonton, Alta.—T. H. Gilmour & Co. of Winnipeg are making inquiries in this district regarding the establishment of a manufacturing plant. It is stated that the company for whom they are acting would be prepared to spend $350,000.

Chatham, Ont.—It is announced that as soon as an agreement has been reached with the C. P. R. regarding a spur line to the site purchased by the Dominion Sugar Company work will be started on the construction of a refinery. A by-law will be voted on to raise $18,500 towards payment for the site.

Municipal

St. Catharines, Ont.—The council contemplate installing an incinerator.

Orillia, Ont.—The Provincial Board of Health has approved of the scheme to install a mechanical filtration plant.

Edson, Alta.—It is proposed to spend $10,000 for fire protection apparatus. A by-law will be submitted on June 29.

Ottawa, Ont.—Preparations are being made to call tenders for the overland pipe. J. B. McRae is consulting engineer.

Kingston, Ont.—The by-law to authorize the expenditure of $,7,000 for the proposed incinerator was passed on June 21.

Hamilton, Ont.—Kerry & Chase, Ltd., engineers, of Toronto, have prepared a report on the proposed reservoir on the mountain top.

Chatham, Ont.—W. G. George, of this town, is preparing plans for a pumping and drainage system for Chatham Township Council.

Guelph, Ont.—Extensions are contemplated to the water supply system. The Provincial Board of Health has approved of the plans.

Watrous, Sask.—An expenditure of $42,000 is contemplated to complete the waterworks system. A by-law will be voted on shortly.

Verdun, Que.—The city council propose making extensions to the waterworks and electric lighting systems. Geo. A. Ward, secretary-treasurer.

Penticton, B.C.—Extensions will be made to the electric light system at a cost of $6,000. A by-law to authorize this expenditure has been passed.

Peterboro, Ont.—The ratepayers will vote on a by-law on July 6 to authorize the purchase of a site and the erection of an electrical sub-station, waterworks office and storehouse. Estimated cost, $50,000. S. R. Armstrong, clerk.

Vancouver, B.C.—Among the by-laws to be voted on by the ratepayers on June 28, is included one to raise $230,000 for waterworks improvements and extensions.

Ailsa Craig, Ont.—A by-law will be voted on by the ratepayers on June 28, to raise $7,729 to cover the cost of an electric power distributing plant.

Ingersoll, Ont.—The town council will submit a by-law to the ratepayers to raise $10,000 for repairs and extensions to the waterworks plant. W. R. Smith, town clerk.

Peterborough, Ont.—A by-law will be voted on by the citizens on July 6 to raise $50,000 to meet the cost entailed in the erection of equipment for the substation.

Montreal, Que. — Hering & Fuller, consulting engineers of New York, have reported in favor of making an addition to the water filtration plant now under construction. The additional unit would be of the mechanical filter type and would have a capacity of 50,000,000 gallons. The total proposed expenditure amounts to $4,500,000 which includes $1,500,000 for a pumping plant.

Sarnia, Ont.—As the result of a report submitted by Engineer Jeffrey, of the Ontario Hydro-Electric Commission, the city council will offer the Sarnia Gas and Electric Co. the sum of $155,000 for its plant and equipment, with the installation of Niagara power the object in view. If the company accepts the offer, as is expected, a Hydro-Electric by-law will probably be submitted to the ratepayers shortly.

Electrical

Petrolia, Ont.—The town council are considering installing a hydro-electric system.

Toronto, Ont.—The Hydro-Electric Power Commission are in the market for a 350 k.v.a. 60-cycle alternator. Office is in the Continental Life Building.

New Incorporations

The W. A. Swayze Co. has been incorporated at Toronto, with a capital of $40,000 to manufacture automobile, wagon and carriage bodies at Toronto. Incorporators—Elmer McLeod Rowand, Oscar Heuman King, of Toronto.

The Universal Stove and Furnace Co. has been incorporated at Ottawa, with a capital of $500,000, to manufacture stoves and furnaces, etc., at Toronto, Ont. Incorporators—George Mortimer Kelley, John Delatre Falconbridge, of Toronto.

The Invincible Machine Co. has been incorporated at Toronto, with a capital of $100,000, to carry on the business of machinists, mechanical engineers, toolmakers and iron and brass founders, at Toronto, Ont. Incorporators — James Young Murdoch, Esca Brooke Daykin, of Toronto, Ont.

The Vacuum Street Cleaning Machine Co. has been incorporated at Ottawa, with a capital of $175,000, to manufacture street sweepers, air cleaners, drying apparatus, etc., at Windsor, Ont. Incorporators—William Thomas Blaney, of Windsor, Ont., and George Samuel Clarke, of Detroit, Mich.

Tenders

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to Monday, June 28, for the supply and erection in place of vault fittings for the city clerk's office, in accordance with plans and specifications, copy of which may be obtained at the office of the city engineer, 223 James Avenue, Winnipeg.

Kingston, Ont.—Tenders will be received up to June 21 for the following work in connection with the civic incinerator: Contract A:—The supply and erection of a 36-in. circular steel stack. Contract B:—The delivery of a 75 h.p tubular boiler. Plans and specifications may be seen at the office of the City Engineer, R. J. McClelland.

Hamilton, Ont.—Tenders will be received by the chairman Board of Control, up to Monday, June 28, for the following works in connection with the Gage Ave. sewage disposal pumping station:—Roofing and sheet metal work, heating, electric lighting, steel roof trusses. Plans and specifications may be seen at the city engineer's office upon application, copies of which may be had on receipt of deposition of $10, which will be refunded on return of same.

Ottawa, Ont.—Tenders will be received until Monday, July 12, for the construction of the superstructure for a bridge, consisting of four spans, over the Quinze River at North Timiskaming, Pontiac County, Que. Plans and forms of contract can be seen and specification and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the district engineers, Shaughnessy Building, Montreal, P.Q.; Confederation Life Building, Toronto, Ont.

Refrigeration

Quebec, Que.—A company has acquired a site at Limoilou, near here, and will build an abattoir and cold storage plant. Contracts to the value of $25,000 have already been awarded for the construction of the plant. Lucien Trotter, of Normandin, is president, and Germain Gagnon, of St. Bruno, is manager of the company.

Contracts Awarded

Sidney, N.S.—A contract has been awarded to Kerr & Co., of Walkerville, Ont., for valves for the new pumping station at a cost of $1,170.

Sidney, N.S.—The contract for the building of the new pumping station at Middle Lake has been awarded to Chappell Bros., Ltd. The amount of their tender was $13,023.60.

Orillia, Ont.—The Town Council has awarded the contract for switch-board and all cables and oil switch to the Northern Electric Co., Toronto, at $2,565, price to include erection.

Redcliffe, Alta.—The rolling mills here have secured the contract for the steel work on the large Centre Street bridge in Calgary. This work will require 500 tons of steel.

Victoria, B.C.—It is announced that the McAlpine Robertson Co. have been awarded the contract for the erection of the Dominion Government observatory on Little Saanich Mountain, the contract price being $75,000.

Orillia, Ont.—The Water, Light and Power Commission has awarded the contract for two 175 h.p. slip ring motors, 1,200 r.p.m., in accordance with specifications, to the Canadian Crocker-Wheeler Co., St. Catharines, at $3,100.

St. Catharines, Ont.—William Riley, of this city, has commenced work on sub-contracts for pile driving on sections 1 and 3 of the Welland Ship Canal. John Morley has also started his sub-contract for drilling in the harbor at Port Weller. It is expected that the work will take nearly four years to complete. A quantity of excavation is also to be handled.

Building Notes

Ingersoll, Ont.—It is proposed to spend the sum of $70,000 in the erection of a new sixteen-roomed school here.

Winnipeg, Man.—Tenders will be called for the erection of a new public

school to be built on the corner of Union Avenue and Gray Street.

Fort William, Ont.—The contract for the construction of a new registry office has been let to M. H. Braden, of this city.

Baldwin's Mills, Que.—W. K. Baldwin will build a sawmill to cost about $10,000. Transmission and woodworking machinery will be required.

Fort William, Ont.—M. H. Braden has been awarded the contract for the building of the new registry office here, by the Ontario Government. He will commence work on the foundations. The cost of the building is estimated at about $26,000.

Sault Ste. Marie, Ont.—The contract for the erection of a new jail building here has been awarded by the Minister of Public Works and formally signed. The building will cost $25,390, and will be built by McIntyre, Haining & Kelly, of Sault Ste. Marie. Plans for a new court house at the "Soo" are also nearing completion.

Railways—Bridges

Newmarket, Ont.—A reinforced concrete bridge will be constructed near here at an estimated cost of $5,000. The York Township Council are doing the work.

Hope, B.C.—The Canadian Northern and the Great Northern Railways will construct terminal buildings, turntables, roundhouses, etc., here. The construction work will begin in a few weeks.

Ottawa, Ont. — Negotiations which have been in progress for a few weeks looking to the acquisition by the Government of the Lake Superior branch of the Grand Trunk Pacific are practically closed. On account of the bonded indebtedness of this branch being complicated with the main line of the G. T. P., a purchase outright was found impracticable. In place of it a long lease is being arranged. It is understood that the rental will be about half a million annually. The interest to be paid by the company is on bonds issued at the rate of $70,000 per mile.

Marine

Quebec, Que.—Seven tenders have been received for the construction of the storage dam at La Loutre, on the St. Maurice River, for the Quebec Streams Commission. The dam will be over 1,000 feet long, and over 85 feet high at the deepest part. The area to

be flooded will constitute one of the greatest reservoirs in America.

Fordonian Breaks Crank Shaft.—The steamer Fordonian, of the Canadian Steamship Lines, the only vessel on the Great Lakes of her size having Diesel engines, broke her crank shaft above above White Fish Point on June 17, just after finishing a trip across Lake Superior. She was picked up by the tug Schencke, of Sault Ste. Marie, and towed to Port Huron. She will probably be taken to Port Colborne for repairs.

C. G. S. Montmagny Action. — The Canadian Government has agreed to settle the action it brought against the steamer Lingan for $400,000 in conjunction with the sinking of the C. G. S. Montmagny, below Quebec, on Sept 8, 1914. The Montmagny was rammed by the Lingan, a collier, and sank, several of her crew and passengers being drowned. It is understood the Government has accepted one hundred thousand dollars. The action was to have been tried in the Admiralty division of the Exchequer Court.

Personal

E. J. Holland, city engineer, of Guelph, Ont., has tendered his resignation to the Board of Works.

R. H. Balfour, of the Montreal Light, Heat and Power Co. has been appointed Chief Engineer of the Montreal Electrical Commission.

Capt. E. L. Squire, of the steamer Fernfield, fell overboard and was drowned on the night of June 11 while his ship was near St. Paul's Island, near Montreal.

Capt. Holmes, who had his master's certificate taken from him on account of his vessel, the Morwenna, coming into collision with a ferry-boat in Halifax harbor some months ago, has had it returned by the Minister of Marine. The Dominion Coal Co., which owned the Morwenna, employed the captain in a minor capacity, and he was on board that steamer when it was torpedoed by a German submarine recently off the coast of Scotland. In view of Capt. Holmes' conduct, the Canadian Minister of Marine has deemed it advisable to hasten the time of giving back to the captain his master's certificate.

Trade Gossip

Kingston, Ont.—The Canadian Locomotive Co. has secured an order from the Russian Government for fifty locomotives.

Halifax, N.S.—The Eastern Car Co. has received a large order for cars from the French Government in addition to that from the Russian Government.

The Rathbun Match Co. has been licensed to carry on business in the Province of Ontario, with a capital not exceeding $40,000. Head office, Deseronto, Ont.

Calgary, Alta.—W. R. Martin will be managing director of the Canadian Western Foundry and Supply Co. The other officers will be W. H. McLaws, chairman; G. A. McKenzie and T. A. McAuley.

The Ambursen Hydraulic Construction Co. of Canada, Ltd., Montreal, has been awarded the contract for the construction of two storage dams on the Nashwaak River, near Marysville, N.B., for the Edward Partington Pulp and Paper Co., Ltd., St. John, N.B.

Halifax, N.S.—The Nova Scotia Tramways and Power Co. have taken the first step to carry into effect the legislation enabling them to take over the properties of the Halifax Electric Tramway Co. and the Nova Scotia Light and Power Co.'s hydraulic powers on the Gaspereau. The petition asks first that the capital of the company be increased to $10,000,000.

Quebec, Que.—With a capital of three million dollars and extensive powers, a new company has been incorporated by Provincial Letters Patent to develop hydraulic powers in the cities of Quebec and Three Rivers and also in various counties in the district. All the promoters are located in Montreal and comprise: Charles H. Branchaud, Milton Lewis Hersey, Howard Murray, Thos. McDougall, and Julian C. Smith.

Toronto, Ont.—Sir Adam Beck, chairman of the Provincial Hydro-Electric Power Commission, recently announced that plans were being prepared for lines which would join seventeen more municipalities to that system. He stated, moreover, that fourteen other municipalities had been in communication with the commission and would ask their electors to vote upon by-laws authorizing their councils to contract with the Provincial Commission for supplies of electricity.

Wheat Through Lachine Canal.—Since the opening of navigation a little over twelve million bushels of wheat has reached Montreal through the Lachine Canal. This is over 1,500,000 bushels less than it was for the same time a year ago. Twenty-six vessels have brought grain, largely wheat, from United States ports, mostly from Duluth and Chicago. During the last month only four Amer-

ican grain carriers have arrived, but there were twenty-two in the early days of the season.

Trade With Russia.—Aemilius Jarvis, of Toronto, has just returned after an absence of about two months, during which time he visited France and Russia, as well as Britain. He spent some time in Petrograd and Moscow. Discussing the prospects of Canadian concerns securing orders from Russia, he said that it took time and pains. Credentials must be the very best, and the representative must in no way be a middleman. The Russian Government always demanded reasonable guarantee that tenderers were in a position to deliver the goods. Initial orders, however, if properly lived up to, would probably be forerunners of much business from Russia.

Catalogues

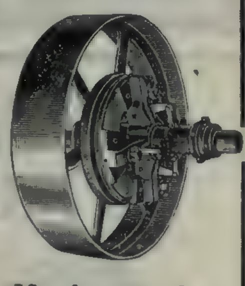
Drill Chips for June published by the Cleveland Twist Drill Co., Cleveland, Ohio, has come to hand. Its feature this month is an interesting dissertation on co-operation with regard to the conduct of business as well as national affairs. There are also included a number of well drawn cartoons.

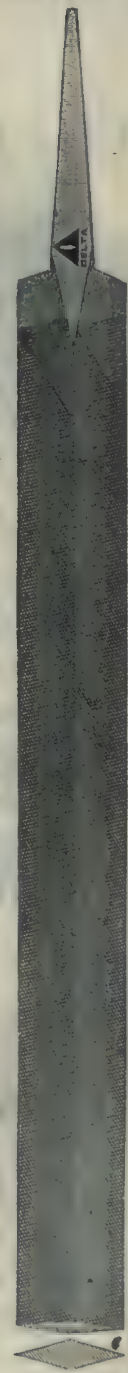
Cutting-off Machines.—Catalogue A-2 describes the new Davis cutting-off machines which are specially adapted for cutting off bar stock in the manufacture of shells. The various sizes in which this machine is made are illustrated and described fully with the principal dimensions given for each.

Steam Traps.—Bulletin G is devoted to descriptions of the various types of steam trap made by the Elliott Company, Pittsburgh, Pa. The principle of operation of the steam trap is first dealt with followed by a comprehensive detail of each type with special reference to their distinctive features. Illustrations and tables are included giving the principal dimensions for each type and size.

Water Columns made by the Elliott Company, Pittsburgh, Pa., are dealt with in bulletin H. recently issued. These water columns are of the alarm type and each pattern is described fully accompanied by illustrations showing the general design and distinctive features. A dimension diagram is shown for each pattern, and in conjunction are tables giving the principal dimensions.

Pressure Oil Filter.—The V. D. Anderson Co., Cleveland, O., have issued a catalogue describing their pressure oil filters. The filtering of oil is dealt with in a general way followed by a description of the Anderson process, its installation and operation. The various types





are described and illustrated and diagrams of typical installations are included. Other specialties described and illustrated are oil pumps, storage tanks, steam and air traps and water columns, etc.

A New "Angle" on an Old Subject, is the title of a bulletin issued by the Detroit Twist Drill Co., Detroit, Mich. The bulletin contains in the opening pages a good deal of useful information on the design and use of twist drills with special reference to the "Detroit" twist drill and its salient points. Other matter consists of a number of practical suggestions for users of twist drills including more useful pointers on grinding drills and speeds and feeds. The concluding pages contain a series of useful mechanical tables. The bulletin is fully illustrated.

Steel Bridges.—The Dominion Bridge Co., Lachine, Que., has issued a new catalogue, S-1, containing views of a large number of bridges of various designs erected in different parts of the country and also of various other steel structures such as buildings, water tanks, coal towers, etc. Several of the bridges are shown during construction and reference is made to the method in which erection problems have been solved. The catalogue indicates the development that has been made in bridge construction in Canada in recent years. The illustrations are excellent reproductions and a brief description accompanies each.

Flow Meters for measuring steam, water, air and gas are described fully in bulletin No. 46501 issued by the Canadian General Electric Co., Toronto, Ont. The Bulletin contains 47 pages devoted to matter relative to flow meters and the principle of operation. The construction and method of operation of each of the various types is described in detail accompanied by numerous illustrations showing the chief features of their design. The indicating and receiving apparatus are also dealt with fully, and the unit of calibration for each type is explained. The concluding pages contain list prices of the various types meters, nozzle plugs and pipe reducers, velocity tables, ordering instructions, and an index to subjects and list prices.

Clergyman Makes Shells.—A call for recruits in Glasgow to assist in the manufacture of shells brought forth a clergyman, who was promptly accepted. He is the Rev. Stuart Robertson, of Pollokshield Church, a tall, athletic figure, who now serves from 6 o'clock in the morning until 5 at night in a large engineering shop. His day's work over, the Rev. Robertson attends to his pastoral duties as his evening's recreation.